

CITY OF EL SEGUNDO

**CONTRACT DOCUMENTS
PLANS & SPECIFICATIONS**

FOR

**RECREATION PARK
TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

**PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
350 MAIN STREET
EL SEGUNDO, CA 90245
310-524-2300**

<https://www.elsegundo.org/government/departments/city-clerk/bid-rfp>

**MANDATORY PRE-BID MEETING
DAY, MARCH 05, 2026, AT 10 AM
RECREATION PARK: TEEN CENTER
(SEE NEXT PAGE FOR LOCATION MAP)
[405 E GRAND AVE, EL SEGUNDO, CA 90245]
EL SEGUNDO, CA 90245**

**BIDS DUE WEDNESDAY, APRIL 01, 2026
AT 11:00 AM**

MANDATORY PRE-BID MEETING LOCATION:



BIDS WILL BE RECEIVED
UP TO THE HOUR
OF 11:00 A.M.

WEDNESDAY, APRIL 01, 2026

IN THE

OFFICE OF THE CITY CLERK
CITY HALL
350 MAIN STREET
EL SEGUNDO, CALIFORNIA 90245

AT WHICH TIME THEY WILL BE
PUBLICLY OPENED

SPECIAL INSTRUCTIONS TO CONTRACTORS

Contractors are required to review section 7-3 of the STANDARD SPECIFICATIONS, pages **II-B-24** thru **II-B-27** “LIABILITY INSURANCE”.

ONLY CONTRACTORS ABLE TO OBTAIN AND FURNISH THE REQUIRED COVERAGE AND ENDORSEMENT “ISO” FORMS SHOULD CONSIDER SUBMITTING A BID PACKAGE.

The Contractor will be required to apply and obtain an Encroachment Permit from the City Public Works Department as well as any applicable Building/Safety Permit from the City Planning and Building Safety Department. The permits will be issued on a “no-fee” basis.

The Contractor shall be responsible for calling the Building Safety Division for inspections. All noted deficiencies shall be corrected by the contractor. The Project will not be accepted as complete until the contractor obtains a final sign-off from the Department of Planning and Building Safety.

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**NOTICE INVITING SEALED BIDS
FOR THE
RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT**

**IN THE CITY OF EL SEGUNDO
PROJECT NO.: PW 25-13**

The City of El Segundo is accepting sealed bids in the City Clerk's office, 350 Main Street, El Segundo, California 90245, until 11:00 a.m. on:

WEDNESDAY, April 01, 2026

at which time they will be publicly opened. Bids will not be accepted after that time.

As described in the Bidding Documents, the bids are for a Public Works Project ("Project") which consists of furnishing all materials, tools, equipment, labor, supervision, incidentals, and related work as shown on the plans on file with the City's Public Works Department.

Work on the Project must be performed in strict conformity with Specifications No. **PW 25-13** as adopted by the El Segundo City Council on **October 21, 2025** which is filed with the Public Works Department.

Plans, Specifications, Contract Documents and Engineer's estimate are available electronically via <https://www.elsegundo.org/government/departments/public-works/request-public-works-bid>

A pre-bid meeting is scheduled for **March 05, 2026 at 10:00am**, at the **Recreation Park Teen Center**, 405 E Grand Ave, El Segundo, CA 90245. Bidders' attendance at this meeting is **mandatory**. Questions regarding the bid shall be submitted by **5:00pm** on **March 16, 2026** to <https://www.elsegundo.org/government/departments/public-works/request-public-works-bid>

The terms and conditions for bidding on the Project are described in the attached Bidding Instructions.

This Project requires payment of State prevailing rates of wages for Los Angeles County. The contractor must post copies of the prevailing schedule at each job site. Copies of these rates of wages are available from the State of California Department of Industrial Relations Prevailing Wage Unit, Telephone No. (415) 703-4774. The website for this agency is currently located at <http://www.dir.ca.gov>.

The contractor to whom the contract is awarded must assist in locating, qualifying, hiring and increasing the skills of minority group employees and applicants for employment, as set forth in Executive Order 11246 and 11375.

Any contract entered into pursuant to this notice will incorporate the provisions of the State Labor Code. Compliance with the prevailing rates of wages and apprenticeship employment standards established by the State Director of Industrial Relations will be required.

Affirmative action to ensure against discrimination in employment practices on the basis of race, color, national origin, ancestry, sex, or religion will also be required.

The City of El Segundo hereby affirmatively ensures that minority business enterprises will be afforded full opportunity to submit bids in response to this notice and will not be discriminated against on the basis of race, color, national origin, ancestry, sex, or religion in any consideration leading to the award of contract.

The Contractor's duty to pay State prevailing wages can be found under Labor Code Section 1770 et. Seq. and Labor Code Sections 1775 and 1777.7 outline the penalties for failure to pay prevailing wages and employ apprentices including forfeitures and debarment.

Five percent (5%) will be deducted from each progress payment and retained by the City. The remainder less the amount of all previous payments will be paid to the Contractor. Pursuant to Public Contracts Code ("PCC") § 22300, the Contractor may substitute securities for retention monies held by the City or request that the City place such monies into an escrow account. The Contractor is notified, pursuant to PCC § 22300, any such election will be at the Contractor own expense and will include costs incurred by the City to accommodate the Contractor's request.

In entering into a Public Works contract, or a subcontract, to supply goods, services, or materials pursuant to a Public Works contract, the **Contractor**, or **Subcontractor**, offers and agrees to assign to the awarding body all rights, title and interest in, and to, all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 [commencing with Section 16700] of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the Public Works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the **Contractor**, without further acknowledgment by the parties.

Bids must be prepared on the approved Proposal forms in conformance with the Instructions to Bidders and submitted to the City Clerk, 350 Main Street, City of El Segundo, in a sealed envelope plainly marked on the outside:

**“SEALED BIDS FOR PROJECT NO.: PW 25-13
RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
IN THE CITY OF EL SEGUNDO**

DO NOT OPEN WITH REGULAR MAIL"

The bid must be accompanied by a bid bond, made payable to the City of El Segundo for an amount no less than **ten percent (10%)** of the amount bid for the base contract.

No bid will be accepted from a **Contractor** who has not been licensed in accordance with the provisions of the State Business and Professions Code. For this Project, those acceptable classes of license shall be **A or B**. The successful **Contractor** and his **Subcontractors** will be required to possess the correct license for their Project classifications, and valid City Business Licenses from the City of El Segundo.

The City of El Segundo reserves the right to reject any or all bids, to waive any irregularity, and to take all bids under advisement for a period of **ninety (90) calendar days**.

Any contract entered into pursuant to this notice shall become effective or enforceable against the City of El Segundo only when the formal written contract has been duly executed by the appropriate officer(s) of the City of El Segundo.

DATED this 12th day of February 2026.

CITY OF EL SEGUNDO, CALIFORNIA

Susan Truax, City Clerk

BIDDING INSTRUCTIONS

1. DEFINITIONS. Unless provided otherwise, the definitions in the Greenbook, Special Conditions, or other Contract Documents are applicable to all Bidding Documents.
 - 1.1 “Addenda” means written or graphic instruments issued by the City before the Bid Deadline that modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.
 - 1.2 “Alternate” means a proposed change in the Work, as described in the Bidding Documents which, if accepted, may result in a change to either the Contract Sum or the Contract Time, or both.
 - 1.3 “Bid Deadline” means the date and time designated in the Notice for Bids as the last date and time for receipt of Bids, as may be revised by Addenda.
 - 1.4 “Bidder” means a person or firm that submits a Bid.
 - 1.5 “Bidding Documents” means the construction documents prepared and issued for bidding purposes including all Addenda
 - 1.6 “Lump Sum Base Bid” means the sum stated in the Bid for which Bidder offers to perform the Work described in the Bidding Documents, but not including unit price items or Alternates.
 - 1.7 “Unit Price” means an amount stated in the Bid for which Bidder offers to perform the Unit Price Work for a fixed price per unit of measurement.
2. BIDDER’S REPRESENTATIONS. By making its Bid, Bidder represents that:
 - 2.1 Bidder read, understood, and made the Bid pursuant to the requirements in the Bidding Documents.
 - 2.2 Bidder visited the Project site and is familiar with the conditions under which the Work will be performed and the local conditions as related to the Contract Documents.
 - 2.3 The Bid is based upon the materials, equipment, and systems required by the Bidding Documents.
 - 2.4 Bidder and all Subcontractors, regardless of tier, have the appropriate current licenses issued by the State of California Contractor’s State License Board for the Work to be performed. If Bidder is a joint venture, the Bidder will have a joint venture license appropriate for the performance of the work, and each member of the joint venture will likewise have the appropriate license. Business and Professions Code §§ 7000-7191 establish licensing requirements for contractors. If a Bidder, that is a specialty contractor, submits a Bid involving 3 or more specialized building trades, the work of which is more than incidental and supplemental to the performance of the Work for which Bidder holds a specialty contractor license, Bidder must also hold either (1) a specialty contractor “C” license in each such trade, (2) a General Engineering contractor “A” license, or (3) a General Building contractor “B” license. This requirement is applicable whether or not Bidder lists a Subcontractor for each such trade.
 - 2.5 If licensure or proper licensure is controverted, then proof of licensure pursuant to this section must be made by production of a verified certificate of licensure from

the Contractors' State License Board which establishes that the individual or entity bringing the action was duly licensed in the proper classification of contractors at all times during the performance of any act or contract covered by the action. Nothing in this subdivision requires any person or entity controverting licensure or proper licensure to produce a verified certificate. When licensure or proper licensure is controverted, the burden of proof to establish licensure or proper licensure is on the licensee.

- 2.6 Bidder has the expertise and financial capacity to perform and complete all obligations under the Bidding Documents.
- 2.7 The person executing the Bid Form is duly authorized and empowered to execute the Bid Form on Bidder's behalf.
- 2.8 Bidder is aware of and, if awarded the Contract, will comply with Applicable Code Requirements in its performance of the Work.
- 2.9 The Bidder has paid the City's business license fee(s)
- 2.10 The Bidder, per SB 854 requirements for public Projects, has registered with and paid their annual fee to the California State Department of Industrial Relations. Information about SB 854 and its requirements can be found at this link:
<http://www.dir.ca.gov/Public-Works/SB854.html>

3. BIDDING DOCUMENTS

- 3.1 Bidders may obtain complete sets of the Bidding Documents electronically via <https://www.elsegundo.org/government/departments/public-works/request-public-works-bid>.
- 3.2 Bidders will use a complete set of Bidding Documents in preparing Bids.
- 3.3 The City makes Bidding Documents available on the City's website for the sole purpose of obtaining Bids for the Work and does not confer a license or grant permission for any other use of the Bidding Documents.

4. INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS.

- 4.1 Before submitting its Bid, Bidder will carefully study and compare the various documents comprising the Bidding Documents and compare them with any other work being bid concurrently or presently under construction which relates to the Work for which the Bid is submitted; will examine the Project site, the conditions under which the Work is to be performed, and the local conditions; and will at once report to the City's Representative errors, inconsistencies, or ambiguities discovered.
- 4.2 Requests for clarification or interpretation of the Bidding Documents will be addressed to the City's Representative.
 - 4.2.1 The release of the bid package begins a quiet period for potential Bidders participating in this Project. The City of El Segundo realizes it is critical to provide Bidders with a vehicle to ask questions so that quality responses can be prepared. Questions must be submitted in writing to project managers via the City website:
<https://www.elsegundo.org/government/departments/public-works/request-public-works-bid>
Responses to all questions will be provided in writing to all Bidders in

accordance with the schedule below. We will not identify companies or individuals that pose questions. Potential bidders must not call City of El Segundo employees to discuss potential projects or ask questions regarding the bid.

Questions Due by MARCH 16, 2026

Questions Answered by MARCH 27, 2026

- 4.3 Clarifications, interpretations, corrections, and changes to the Bidding Documents will be made by Addenda. Clarifications, interpretations, corrections, and changes to the Bidding Documents made in any other manner will not be binding and Bidders must not rely upon them.
5. **PRODUCT SUBSTITUTIONS.** No substitutions will be considered before award of Contract. Substitutions will only be considered after award of the Contract and as provided for in the Contract Documents.
6. **SUBCONTRACTORS.**
 - 6.1 Each Bidder will list in the Bid Form all first-tier Subcontractors that will perform work, labor or render such services. The Bid Form contains spaces for the following information when listing Subcontractors: (1) Work Activity; (2) name of Subcontractor; (3) city of Subcontractor's business location. Failure to list any of these items on the Bid Form will result in the City treating the Bid as if no Subcontractor was listed for the Work and that Bidder represents to the City that it is fully qualified to perform that portion of the Work and will perform do so.
 - 6.2 Subcontractors listed in the Bid Form will only be substituted after the Bid Deadline with the City's written consent in accordance with California law.
7. **ADDENDA.**
 - 7.1 Addenda will be in writing and issued only by the City. Addenda will be emailed to all who are known by the City to have received a complete set of Bidding Documents and who have provided an email address for receipt of Addenda.
 - 7.2 Copies of Addenda will be made available for inspection at the City's Public Works Department.
 - 7.3 The City will issue Addenda so that they are received by prospective Bidders not later than three (3) business days before the Bid Deadline. Addenda that withdraw the request for Bids or postpone the Bid Deadline may be issued anytime before the Bid Deadline.
 - 7.4 Each Bidder is responsible for ensuring that it has received all issued Addenda before issuing a Bid.
8. **PRE-BID CONFERENCE.** Bidder will attend a Pre-Bid Conference where the City will discuss the Bidding Documents, answer questions, accept comments, and conduct a Project site visit. The City requires all Pre-Bid Conference attendees to arrive for the meeting on time and to sign an attendance list which is used to determine if Bidders meet

this requirement. Any Bidder not attending the Pre-Bid Conference in its entirety will be deemed to have not complied with the requirements of the Bidding Documents and its Bid will be rejected.

9. FORM AND STYLE OF BIDS

- 9.1 Bids will be submitted on the Bid Form included with the Bidding Documents. Bids not submitted on the City's Bid Form will be rejected.
- 9.2 All blanks on the Bid Form will be filled in legibly in ink or typewritten by computer.
- 9.3 Bidder's failure to submit a price for any Alternate or unit price will result in the Bid being considered as nonresponsive. If Alternates are called for and no change in the Lump Sum Base Bid is required, enter "No Change."
- 9.4 Each Bidder must fill out the "Bidders Statement of Past Contract Disqualifications" form stating any and all instances of contract disqualifications due to a violation of a law or safety regulation. The Bidder must explain the circumstances of each disqualification. The City may reject the bid based on such information.
- 9.5 Bidder will make no stipulations on the Bid Form nor qualify the Bid in any manner.
- 9.6 The Bids will be based upon full completion of all the Work as shown on the plans and specifications. It is expressly understood that the plans are drawn with as much accuracy as is possible in advance, but should errors, omissions or discrepancies exist in the plans which show conditions that vary from those encountered in construction, the Bidder (if awarded the Contract) specifically agrees to construct a completed work ready for the use and in the manner which is intended. In the event of increasing or decreasing of work, the total amount of work actually done or materials or equipment furnished must be paid for according to the unit or lump sum price established for such work under the contract, wherever such unit or lump sum price has been established. In the event no prices are named in the contract to cover such changes or alterations, the cost of such changes must be covered as extra work.
- 9.7 The Bid Form will be signed by a person or persons legally authorized to bind Bidder to a contract. Bidder's Representative will sign and date the Declaration included in the Bid Form. Failure to sign and date the declaration will cause the Bid to be rejected.
- 9.8 Bids must be submitted in writing on the Proposal forms provided by the City of El Segundo. One (1) set of these Proposal forms is inserted loose herein for use by the bidders. **Bidders are required to submit one (1) original set of the proposal forms.** All information requested therein must be clearly and legibly set forth in the manner and form indicated.
- 9.9 Bidders must satisfy themselves by personal examination of the work site, Plans, Specifications, and other contract documents, and by any other means as they may believe necessary, as to the actual physical conditions, requirements and difficulties under which the work must be performed. No bidder shall at any time after submissions of a proposal make any claim or assertion that there was any misunderstanding or lack of information regarding the nature or amount of work

necessary for the satisfactory completion of the job. Any errors, omissions, or discrepancies found in the Plans, Specifications, or other contract documents shall be called to the attention of the City of El Segundo and clarified prior to the submission of proposals.

10. BID SECURITY

- 10.1 Each Bid will be accompanied by Bid Security, in the amount of 10% of the Lump Sum Base Bid as security for Bidder's obligation to enter into a Contract with the City on the terms stated in the Bid Form and to furnish all items required by the Bidding Documents. Bid Security will be a Bid Bond on the form provided by the City or a certified check made payable to "City of El Segundo." When a Bond is used for Bid Security, failure to use the City's Bid Bond form will result in the rejection of the Bid.
- 10.2 If the apparent lowest responsible Bidder fails to sign the Agreement and furnish all items required by the Bidding Documents within the time limits specified in these Instructions to Bidders, the City will disqualify such Bidder and select the next apparent lowest responsible Bidder until all bids have been exhausted or the City may reject all bids. In such an event, the disqualified Bidder will be liable for and forfeit to the City the amount of the difference, not to exceed the amount of the Bid Security, between the amount of the disqualified Bid and the larger amount for which the City procures the Work.
- 10.3 If a Bid Bond is submitted and an attorney-in-fact executes the Bid Bond on behalf of the surety, a notarized and current copy of the power of attorney will be affixed to the Bid Bond. The surety issuing the Bid Bond will be listed in the latest published State of California, Department of Insurance list of, "Insurers Admitted to Transact Surety Insurance in This State."
- 10.4 The City will retain Bid Security until the occurrence of one of the following:
 - 10.4.1 All items required by the Bidding Documents have been furnished and the Agreement has been signed by the successful Bidder and the City.
 - 10.4.2 The specified time has elapsed during which Bids may be withdrawn.
 - 10.4.3 All Bids have been rejected.
- 10.5 **The Bid Form, Bid Security, and all other documents required to be submitted with the Bid must be enclosed in a sealed opaque envelope. The envelope must be addressed to the City Clerk. The envelope must be identified with the Bidder's name and address, and identify the Project for which the Bid is submitted, as follows: "SEALED BIDS FOR PW 25-13: RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK RENOVATION PROJECT. DO NOT OPEN WITH REGULAR MAIL." Proposals may be mailed or delivered by messenger.**
- 10.6 Bids will be deposited at the designated location on or before the Bid Deadline. A Bid received after the Bid Deadline will be returned to Bidder unopened.
- 10.7 Bidder will assume full responsibility for timely delivery at the location designated for receipt of Bids.
- 10.8 Oral, telephonic, facsimile, or telegraphic Bids are invalid and will not be accepted.
- 10.9 All proposals must be submitted, filed, made, and executed in accordance with

State and Federal laws related to bids for contracts of this nature whether the same is expressly referred to herein or not. Any bidder submitting a proposal shall by such action thereby agree to each and all of the terms, conditions, provisions, and requirements set forth, contemplated, and referred to in the Plans, Specifications, and other contract documents, and to full compliance therewith.

11. MODIFICATION OR WITHDRAWAL OF BID.

- 11.1 Before the Bid Deadline, a submitted Bid may be modified or withdrawn. Notice of such action will be given to the City in writing and signed by the Bidder's authorized representative. A change so made will be so worded as not to reveal the amount of the original Bid.
- 11.2 A withdrawn Bid may be resubmitted up to the Bid Deadline, provided that it then fully complies with the Bidding Requirements.
- 11.3 Bid Security will be in an amount sufficient for the Bid as modified or resubmitted.
- 11.4 Bids may not be modified, withdrawn, or canceled within ninety (90) calendar days after the Bid Deadline unless otherwise provided in Supplementary Instructions to Bidders.
- 11.5 Proposals may not be withdrawn after said Bid Deadline without forfeiture of the proposal guarantee.
- 11.6 The withdrawal of a proposal will not prejudice the right of the bidder to submit a new proposal, providing there is time to do so.
- 11.7 No mention shall be made in the proposal of Sales Tax, Use Tax, City Business License, or any other tax, as all amounts bid will be deemed and held to include any such taxes, which may be applicable.
- 11.8 No mention shall be made in the proposal of the cost of bonds as all amounts bid will be deemed and held to include any such costs, which may be applicable.

12. OPENING OF BIDS. Bids submitted in the manner required by these instructions and are received on or before the Bid Deadline will be opened publicly.

13. REJECTION OF BIDS.

- 13.1 The City will have the right to reject all Bids.
- 13.2 The City will have the right to reject any Bid not accompanied by the required Bid Security or any other item required by the Bidding Documents, or a Bid which is in any other way materially incomplete or irregular.
 - 13.2.1 Unrequested/unauthorized conditions, limitations, or provisions attached to a proposal will render it irregular and may cause its rejection. The completed proposal forms shall be without interlineations, alterations, or erasures. Alternative proposals will not be considered unless specifically requested. No oral, telegraphic, or telephonic proposal, modification, or withdrawal will be considered.
- 13.3 In the event that any bidder acting as a prime contractor has an interest in more than one proposal, all such proposals will be rejected, and the bidder will be disqualified. This restriction does not apply to subcontractors or suppliers who may submit quotations to more than one bidder, and while doing so, may also

submit a formal proposal as a prime contractor. No proposal will be accepted from a bidder who has not been licensed in accordance with the provisions of the State Business and Professions Code.

14. AWARD

- 14.1 The City may retain all bids for a period of ninety (90) calendar days for examination and comparison, and to delete any portion of the work from the contract.
- 14.2 The City will have the right to waive nonmaterial irregularities in a Bid and to accept the lowest responsive Bid as determined by The City.
- 14.3 The City will have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents.
- 14.4 Unless stated otherwise on bidding documents (e.g., Bid Schedule), the City will determine the low Bidder on the basis of the sum of the Lump Sum Base Bid plus all unit prices multiplied by their respective estimated quantities as stated in the Bid Form, if any, plus the Contractor Delay Damages multiplied by the “multiplier” as stated in the Bid Form, plus the amounts of all accepted Alternates.
 - 14.4.1 Inclusion of Contractor Delay Damages within the Bid Form is solely for the purpose of determining the low bidder and establishing the City’s maximum daily liability as a result of City delays to Contractor, if any, and City has no obligation to pay any daily Contractor Delay Damages except as provided for in these Contract Documents for Compensable Delays. In the event that City becomes liable to Contractor for compensable delays, City agrees to pay Contractor the daily Contractor Delay Damages set forth in the Proposal Form or Contractor’s actual daily delay damages, whichever is less, for each day of Compensable Delay as provided for by these Contract Documents.
- 14.5 The City will select the apparent lowest responsive and responsible Bidder and notify such Bidder within thirty (30) calendar days (unless number of days is modified in Supplementary Instructions to Bidders) after the Bid Deadline or reject all bids. Within ten (10) days after receiving the City’s notice that Bidder was selected as the apparent lowest responsive Bidder, Bidder will submit to the City all of the following items:
 - 14.5.1 One original of the Agreement signed by Bidder.
 - 14.5.2 One original of the Payment Bond.
 - 14.5.3 One original of the Performance Bond.
 - 14.5.4 Certificates of Insurance on form provided by the City.
 - 14.5.5 Names of all Subcontractors, with their addresses, telephone number, facsimile number, trade on Bidders’ company stationery. Evidence, as required by the City, of the reliability and responsibility of the proposed Subcontractors such as statements of experience, statements of financial condition, and references.
 - 14.5.6 Preliminary Contract Schedule.
 - 14.5.7 Selection of Retention Options and Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention. If not submitted, the City will withhold retention.

14.5.8 Cost Breakdown.

- 14.6 Before award of the Contract, the City will notify Bidder in writing, if the City objects to a Subcontractor proposed by Bidder, in which case Bidder will propose a substitute acceptable to the City. Failure of the City to object to a proposed Subcontractor before award will not preclude the City from requiring replacement of any Subcontractor based upon information received subsequent to award, information which cannot be properly evaluated before award due to time constraints, or information relating to a failure to comply with the requirements of the Contract.
- 14.7 If Bidder submits the original signed Agreements and all other items within ten (10) days after receiving the City's notification, and all such items comply with the requirements of the Bidding Documents, the City will award the Contract to Bidder by signing the Agreement and returning a signed copy of the Agreement to Bidder.
- 14.8 If the City consents to the withdrawal of the Bid of the apparent lowest responsible Bidder, or the apparent lowest responsible Bidder fails or refuses to sign the Agreement or submit to the City all of the items required by the Bidding Documents, within ten (10) days after receiving the City's notification, or the City determines that the Bidder is not financially or otherwise qualified to perform the Contract, the City may reject such Bidder's Bid and select the next apparent lowest responsible Bidder, until all bids are exhausted, or reject all Bids.

**PROPOSAL
FOR THE
RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

Date _____, 20____

Company Name: _____
TO THE CITY OF EL SEGUNDO:

In accordance with the City of El Segundo's Notice Inviting Sealed Bids, the undersigned **BIDDER** hereby proposes to furnish all materials, equipment, tools, labor, and incidentals required for the above stated Project as set forth in the Plans, Specifications, and contract documents therefor, and to perform all work in the manner and time prescribed therein.

BIDDER declares that this proposal is based upon careful examination of the work site, Plans, Specifications, Instructions to Bidders, and all other contract documents. Submittal of this bid shall be considered evidence that the **BIDDER** has satisfied himself regarding the contract documents, access and any other field conditions which may affect bid prices. If this proposal is accepted for award, **BIDDER** agrees to enter into a contract with the City of El Segundo at the unit and/or lump sum prices set forth in the following Bid Schedule. **BIDDER** understands that failure to enter into a contract in the manner and time prescribed will result in forfeiture to the City of El Segundo of the proposal guarantee accompanying this proposal.

BIDDER understands that a bid is required for the entire work, that the estimated quantities set forth in the Bid Schedule are solely for the purpose of comparing bids, and that final compensation under the contract will be based upon the actual quantities of work satisfactorily completed. **THE CITY OF EL SEGUNDO RESERVES THE RIGHT TO INCREASE OR DECREASE THE AMOUNT OF ANY QUANTITY SHOWN AND TO DELETE ANY ITEM FROM THE CONTRACT.** It is agreed that the unit and/or lump sum prices bid include all apparent expenses, taxes, royalties, and fees. In the case of discrepancies in the amounts bid, unit prices shall govern over extended amounts, and words shall govern over figures.

If awarded the Contract, the undersigned further agrees that in the event of the **BIDDER'S** default in executing the required contract and filing the necessary bonds and insurance certificates within ten working days after the date of the City of El Segundo's notice of award of contract to the **BIDDER**, including sending by U.S. Mail a Public Works Contract for signature by the Awardee, the proceeds of the security accompanying this bid shall become the property of the City of El Segundo and this bid and the acceptance hereof may, at the City of El Segundo's option, be considered null and void.

EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE

BIDDER certifies that in all previous contracts or subcontracts, all reports which may have been due under the requirements of any agency, State, or Federal equal employment opportunity orders have been satisfactorily filed, and that no such reports are currently outstanding.

AFFIRMATIVE ACTION CERTIFICATION

BIDDER certifies that affirmative action has been taken to seek out and consider minority business enterprises for those portions of the work to be subcontracted, and that such affirmative actions have been fully documented, that said documentation is open to inspection, and that said affirmative action will remain in effect for the life of any contract awarded hereunder. Furthermore, **BIDDER** certifies that affirmative action will be taken to meet all equal employment opportunity requirements of the contract documents.

NONCOLLUSION DECLARATION

BIDDER declares that the only persons or parties interested in this proposal as principals are those named herein; that no officer, agent, or employee of the City of El Segundo is personally interested, directly or indirectly, in this proposal; that this proposal is made without connection to any other individual, firm, or corporation making a bid for the same work and that this proposal is in all respects fair and without collusion or fraud.

BID SCHEDULE

RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK RENOVATION PROJECT PROJECT NO.: PW 25-13

Company Name: _____

Note: Bid Item work is elaborated in detail in the Project plans and specifications.

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
BASE BID ITEMS					
1	Mobilization/Demobilization: General Conditions, Permits, Surveying, Cleanup and Dust Control, Temporary Construction and Protection of Existing Improvements, Permits, Licensing, Traffic Control, Public Convenience Erosion Control, SWPPP, and Safety	LS	1	\$	\$
2	Hazardous Materials Allowance: Miscellaneous hazardous material remediation as determined necessary by the engineer.	LS	1	\$50,000	\$50,000
3	Interior Furniture Allowance	LS	1	\$75,000	\$75,000
4	Entire Site Electrical Utilities: Protect in place utility, site security.	LS	1	\$	\$
5	Site Lighting: Retrofit of Existing	LS	1	\$	\$
TEEN CENTER					
6	Superstructure: Roof mechanical equipment pad, parapet extension, CMU wall openings, and misc. metals, connections, blocking, dowels etc.	LS	1	\$	\$
7	Exterior Enclosure: New plaster to ex CMU, prime and paint exterior walls, new storefront, with tempered glazing, new windows, double doors in storefront, class coiling doors, single aluminum and glass door, specialty hardware, refinish and repaint ex canopy.	LS	1	\$	\$
8	Roofing: New spray polyurethane foam finish, canopy including accessories, repaint ex downspout.	LS	1	\$	\$
9	Interior Construction: Interior partitions, interior glazing, interior doors, frames and hardware, millwork, specialties, fire extinguisher cabinets, ceiling track for curtain, misc. specialties.	LS	1	\$	\$

10	Interior Finishes: Floor finishes, wall finishes, ceiling finishes, clean and painted existing beams, soffits and bulkheads.	LS	1	\$	\$
11	Plumbing: Plumbing demo, fixtures, sanitary waste, vent and service pipework, plumbing equipment, storm drainage, misc. plumbing requirements.	LS	1	\$	\$
12	HVAC: HVAC demo, HVAC equipment, air distribution, diffusers, registers and grilles, testing and balancing, temperature controls, misc. HVAC requirements.	LS	1	\$	\$
13	Fire Protection	LS	1	\$	\$
14	Electrical: Trade demolition, service distribution, machine and equipment power, user convenience power, lighting and lighting controls, telecom, security, fire alarm, audio visual rough in, misc. electrical requirements.	LS	1	\$	\$
15	Equipment Furnishing: Provide furnishing, installation, integration, and commissioning of a complete interior Audio-Visual (AV) system, including projection screen (approximately 159-inch diagonal, 16:9 format, Da-Lite or approved equal), ceiling-mounted projector (performance-based, integrator-selected per TA drawings), projector mounting hardware and supports, distributed speakers as indicated, AV rack equipment and electronics, control interface, signal and control cabling, terminations, labeling, system programming, testing, commissioning, and owner orientation. Item also includes furnishing and installation of manual roller shades for four (4) interior windows, sized per the Window Schedule. All work shall be in accordance with Sheets T0.00 through TA9.01 and A6.10.	LS	1	\$	\$
16	Selective Building Demolition: Exterior demolition - cement extrusions, partial demolition for new windows and rolling doors, ex windows, storefront, and metal screens, exterior doors. Interior demolition –carpet at stage area, interior doors, millwork, partitions, portion of wall, stage and ramp, steps, toilet partitions and accessories and floor wall and ceiling finishes.	LS	1	\$	\$

TEEN PLAZA					
17	Site Preparation: Site demolition (exclusive of skatepark), asphalt, concrete pavement, ramp curb and gutter, site wall, planter, landscape, fence, double gate, stone bench, and misc. site demo. Site prep - Clearing and grubbing, fine and rough grading, scarify and recompact soil, over excavate and recompact soil. Site protection.	LS	1	\$	\$
18	Site Improvements: Paving, ramp, steps, asphalt, concrete curb, concrete seatwalls, retaining walls, monument sign, and footings for walls and signs, fence post foundation, sport court surfacing and markings, handrails, multi-purpose court markings, ADA parking, speed dowels, score and expansion joints.	LS	1	\$	\$
19	Sports Equipment: Basketball posts and hoops, volleyball post sleeve.	LS	1	\$	\$
20	Fences and Gates: 48" high perimeter fence, 8' high fence, 10' high fence, 3' pedestrian gate, sliding gate.	LS	1	\$	\$
21	Landscape: Mulch, cobble, shrubs, irrigation.	LS	1	\$	\$
22	Miscellaneous: Striping, wheel stop, site signage, bike racks, steel edge for concrete seatwalls, trash and recycle receptacle, site patching.	LS	1	\$	\$
23	Site Mechanical Utilities: Site utility demo - Remove vault and pump equipment, curb drain. Site drainage – Drain basins, piping, connectors, catch basins, miscellaneous site mechanical requirements, supervision, documentation, and updates.	LS	1	\$	\$
24	Underground Infiltration System: Retention surface area and 50' long retention chamber in accordance to Sheet. C5.01	LS	1	\$	\$
SKATEPARK (Sheets SK1.0 through SK9.3					
25	Earthwork and Site Preparation: Existing skatepark demolition – Fully removed all slabs, surfacing, skatepark amenities and associated foundations and footings and features, over excavation and recompact. Subgrade prep.	LS	1	\$	\$
26	Drainage: Provide area drains, associated piping, fittings, connectors, and miscellaneous	LS	1	\$	\$

	subsurface drainage components required to serve the skatepark improvements, in accordance with the limits of work shown on Sheet SK2.0 and the drainage plan on Sheet SK6.0.				
27	Skatepark Construction: Inclusive of all labor, materials, and equipment required for skatepark construction, including cast-in-place concrete, shotcrete, precast concrete elements, specialty steel features and coping, pool coping, grind rails, edge protection, geofoam (as required), and all coordination associated with site constraints and skate performance.	LS	1	\$	\$
28	Concrete Color and Pool Coping: Colored cast-in-place concrete elements/terrain, and brick-stamped colored cast-in-place concrete flatwork, standard paint (Smokestack red & white) smokestack skatepark feature and pool coping.	LS	1	\$	\$
29	Water Tower Feature: Natural gray colored concrete to "Water Tower Blue" standard paint and Standard black paint to City name lettering in accordance to Sheet SK4.0/SK9.3	LS	1	\$	\$

TOTAL BID (#1 thru #29) = \$ _____

TOTAL BID WRITTEN IN WORDS:

NOTE:

- 1) **THE AWARD TO THE APPARENT LOWEST BIDDER IS BASED ON THE TOTAL OF BASE BID ITEMS ONLY. ALTERNATIVE BID ITEMS SHALL NOT BE CONSIDERED AS PART OF THE LOWEST BID.**
- 2) **THE AWARDED BIDDER SHALL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF VALUES FOR ALL BID ITEMS AT THE TIME OF THE PRE-CONSTRUCTION MEETING. SUBMISSION OF THE SCHEDULE OF VALUES IS NOT REQUIRED AS PART OF THE BID PROPOSAL.**

All work shall be per these specifications and attachments. Prevailing wage rates apply. The City of El Segundo reserves the right to reject any or all bids, to waive any irregularity, and to take all bids under advisement for a period of **ninety (90) calendar days**.

ALTERNATIVE BID ITEMS

**RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
ALTERNATIVE BID ITEMS					
A	Site Lighting: Add alternate to remove existing site lighting, poles and fixtures, and install new (included in the base bid) to colored concrete using white cement with blue tint.	LS	1	\$	\$
B	Skatepark-Water Tower Add alternate to modify the Water Tower feature from natural gray concrete (included in the base bid) to colored concrete using white cement with blue tint. The add alternate shall represent a net adjustment, including a credit for the gray concrete and an addition for the colored concrete in accordance to Sheet SK9.3B	LS	1	\$	\$

BIDDER'S INFORMATION

Company Name: _____

BIDDER certifies that the following information is true and correct:

Form of Legal Entity (i.e., individual, partnership, corporation, etc.) _____

If corporation, State of Incorporation (i.e., California) _____

Business _____

Street Address _____

Telephone No. _____ Email Address _____

State Contractor's License No. and Class _____

Original Date Issued _____ Expiration Date _____

Contractor's Department of Industrial Relations (DIR) Information:

Registration No. _____ Expiration Date _____

The following are the names, titles, addresses, and phone numbers of all individuals, firm members, partners, joint venturers, and/or corporate officers having principal interest in this proposal:

The date of any voluntary or involuntary bankruptcy judgments against any principal having an interest in this proposal is as follows:

All current and prior DBA's, aliases, and/or fictitious business names for any principal having an interest in this proposal are as follows:

BIDDER'S INFORMATION (CONTINUED)

Company Name: _____

Bidder shall list the name of the person who attended the mandatory pre-bid job walk:

Name: _____

Title: _____

IN WITNESS WHEREOF, BIDDER executes and submits this proposal with the names, titles, hands, and seals of all aforementioned principals this _____ day of _____, 20____.

BIDDER NAME AND CONTACT INFORMATION

Bidder Signature: _____

Subscribed and sworn to this _____ day of _____, 20____.

NOTARY PUBLIC

**PROPOSAL GUARANTEE
BID BOND**

**RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

KNOW ALL MEN BY THESE PRESENTS that,

_____, as **BIDDER**, and

_____, as **SURETY**, are held and firmly bound unto the City of El Segundo, in the penal sum of _____ **DOLLARS (\$_____)**, which is ten (10%) percent of the total amount bid by **BIDDER** to the City of El Segundo for the above stated Project, for the payment of which sum, **BIDDER and SURETY agree to be bound, jointly and severally, firmly by these presents.**

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that, whereas **BIDDER** is about to submit a bid to the City of El Segundo for the above stated Project, if said bid is rejected, or if said bid is accepted and a contract is awarded and entered into by **BIDDER** in the manner and time specified, then this obligation shall be null and void, otherwise it shall remain in full force and effect in favor of the City of El Segundo.

IN WITNESS WHEREOF the parties hereto have set their names, titles, hands, and seals this

_____ day of _____, 20____.

BIDDER*

SURETY*

Subscribed and sworn to this _____ day of _____, 20____.

NOTARY PUBLIC

*Provide **BIDDER/SURETY** name, title, address and telephone number and the name, title, address and telephone number for authorized representative.

CONTRACTOR'S LICENSE DECLARATION
(Business and Professions Code Section 7028.15)

1. **BIDDER'S** Contractor's License Number is: _____

Class No.: _____

2. The expiration date of **BIDDER'S** Contractor License is: _____

3. **BIDDER** acknowledges that Section 7028.15(e) of the Business and Professions Code provides as follows:

"A licensed contractor shall not submit a bid to a public agency unless his or her contractor's license number appears clearly on the bid, the license expiration date is stated, and the bid contains a statement that representations herein are made under penalty of perjury. Any bid not containing this information, or a bid containing information which is subsequently proven false, shall be considered non-responsive and shall be rejected by the public agency."

The undersigned declares, under penalty of perjury, that the representations made by the undersigned in this bid proposal are true and correct.

Executed on _____, 20____, at

_____ (insert City and State where Declaration signed).

Signature

Typed Name

Title

Company Name

NON-COLLUSION DECLARATION
TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID
(pursuant to Cal. Pub. Contract Code § 7106)

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 that 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]."

Dated this _____ day of _____, 20____.

Name

Title

Signature

WORKER'S COMPENSATION CERTIFICATION

Section 1861 OF THE LABOR CODE (Workers' Compensation)

Pursuant to Section 1861 of the Labor Code, the **BIDDER**, in submitting his/her **PROPOSAL**, shall sign the following certification:

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

Signature of Bidder: _____

Title: _____

Business Name: _____

Business Address: _____

Telephone Number: (____) _____

Dated this _____ day of _____, 20____.

**BIDDER'S CERTIFICATION OF SUBCONTRACTORS
RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

Company Name: _____

As detailed in Section 2-3 (Page II-B-3) of the General Provisions, Bidder certifies that it has listed below all subcontractors who will perform work in excess of one-half of one percent (0.5%) of the total bid price or certifies that the bidder is fully qualified to perform and will perform that portion of the work itself.

Name of Subcontractor	Address	Subcontractor's Contractor License No. & DIR Registration No.	Description of Portion of Work Subcontracted	Estimated \$ Amount
	(Number and Street)	(CSLB #)		
	(City, Zip Code)	(DIR #)		

(Make copies of this page if additional space is needed)

Signature of Bidder Date

REFERENCES

Company Name: _____

The following are the names, addresses, and telephone numbers for public agencies for which **BIDDER** has performed similar work as the prime contractor or major subcontractor within the past five (5) years. Required to provide five (5) references:

1. Project Owner: _____

Project title: _____
Type of work: _____
Contact name: _____
Telephone: _____
Email address: _____
Contract amount: \$ _____
Date completed: _____

Did your firm have any financial interest in Project? _____

2. Project Owner: _____

Project title: _____
Type of work: _____
Contact name: _____
Telephone: _____
Email address: _____
Contract amount: \$ _____
Date completed: _____

Did your firm have any financial interest in Project? _____

3. Project Owner: _____

Project title: _____
Type of work: _____
Contact name: _____
Telephone: _____
Email address: _____
Contract amount: \$ _____
Date completed: _____

Did your firm have any financial interest in Project? _____

4. Project Owner: _____

Project title: _____

Type of work: _____

Contact name: _____

Telephone: _____

Email address: _____

Contract amount: \$ _____

Date completed: _____

Did your firm have any financial interest in Project? _____

5. Project Owner: _____

Project title: _____

Type of work: _____

Contact name: _____

Telephone: _____

Email address: _____

Contract amount: \$ _____

Date completed: _____

Did your firm have any financial interest in Project? _____

PRIOR SPECIALTY SKATEPARK CONSTRUCTION EXPERIENCE

The specialty skatepark contractor is required to have constructed 2 (two) concrete skateparks of a minimum of 15,000 square feet for a public entity within the United States within the last 5 (five) years. Projects must have been open and continuously in operating condition for at least 1 (one) year.

1. Contractor Name: _____

Contractor Scope: _____

Project Owner name: _____

Owner Contact Info: _____

Square Footage: _____

Contract amount: \$ _____

Date completed: _____

2. Contractor Name:

Contractor Scope: _____
Project Owner name: _____
Owner Contact Info: _____
Square Footage: _____
Contract amount: \$ _____
Date completed: _____

Bidder may attach additional reference pages if necessary.

The following are the names, addresses, and telephone numbers for all brokers and sureties from whom **BIDDER** intends to procure insurance bonds:

**BIDDER'S STATEMENT OF
PAST CONTRACT DISQUALIFICATIONS**

**RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

Company Name: _____

Please state all instances of being disqualified, removed, or otherwise prevented from bidding on, or completing, a federal, state, or local government project due to a violation of a law or safety regulation.

1. Have you ever been disqualified from any government contract?

Yes ☐ No ☐

2. If yes, explain the circumstances:

3. Are you registered in accordance with Labor Code § 1725.5 [Note: failure to register requires the City to reject your bid as nonresponsive]?

Yes ☐ No ☐

Bidder's Signature

Name (Please Print)

INSURANCE REQUIREMENTS
[MUST BE SUBMITTED WITH PROJECT PROPOSAL]
RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13

Company Name: _____

To be awarded this contract, the successful bidder must procure and maintain the following types of insurance with coverage limits complying, at a minimum, with the limits set forth below:

<u>Type of Insurance</u>	<u>Limits</u>
Commercial general liability:	\$2,000,000
Business automobile liability:	\$1,000,000
Workers compensation:	Statutory requirement

**The city has the option to increase the limits as required for more complex and major waterworks, sanitation, and road pavement projects.*

Commercial general liability insurance must meet or exceed the requirements of ISO-CGL Form No. CG 00 01 04 13. The amount of insurance set forth above must be a combined single limit per occurrence for bodily injury, personal injury, and property damage for the policy coverage. Liability policies must be endorsed to name the City, its officials, and employees as “additional insureds” under said insurance coverage and to state that such insurance will be deemed “primary” such that any other insurance that may be carried by the City will be excess thereto. Such insurance must be on an “occurrence,” not a “claims made,” basis and will not be cancelable or subject to reduction except upon thirty (30) days prior written notice to the City. Insurer will agree in writing to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by Contractor for the City.

Automobile coverage must be written on ISO Form CA 00 01, covering Code 1 (Any Auto).

The Contractor must furnish to the City duly authenticated Certificates of Insurance evidencing maintenance of the insurance required under this Agreement, endorsements as required herein, and such other evidence of insurance or copies of policies as may be reasonably required by the City from time to time. Insurance must be placed with admitted insurers with a current A.M. Best Company Rating equivalent to at least a Rating of “A:VII.” Certificate(s) must reflect that the insurer will provide thirty (30) day notice of any cancellation of coverage. The Contractor will require its insurer to modify such certificates to delete any exculpatory wording stating that failure of the insurer to mail written notice of cancellation imposes no obligation, and to delete the word “endeavor” with regard to any notice provisions.

The City requires California Worker’s Compensation Coverage with the associated Waiver. Out-of-state coverage will not be accepted in lieu of the California coverage, because the work is being performed in the State of California.

By signing this form, the bidder certifies that it has read, understands, and will comply with these insurance requirements if it is selected as the City’s Contractor. Failure to provide this insurance will render the bidder’s proposal “nonresponsive.”

Date

Bidder’s Signature

END PROPOSAL SECTION



**PUBLIC WORKS AGREEMENT
BETWEEN
THE CITY OF EL SEGUNDO AND**

**RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW 25-13**

This CONTRACT is entered into this ____ day of ___, 20___, (“Effective Date”) by and between the City of El Segundo, a municipal corporation and general law city (“City”) and [Entity Name], a _____[Location and type of entity, e.g., a California corporation]_____ (“Contractor”).

1. WORK.

- A. The Contractor shall perform all work required by and set forth in the Contract Documents (the “Work”) in a good and workmanlike manner for the project identified in the Contract Documents, as attached hereto and incorporated by reference. The Contractor agrees to perform additional work arising from changes ordered by the City in accordance with the Contract Documents.
- B. The Contractor shall furnish all of the labor; supplies and materials; equipment; printing; vehicles; transportation; office space and facilities; all tests, testing and analyses; and all matters whatsoever (except as otherwise expressly specified to be furnished by the City) needed to perform and complete the Work and provide the services required of the Contractor by the Contract Documents.
- C. The Contractor and the City agree to abide by the terms and conditions contained in the Contract Documents. “Contract Documents” means this Contract and the following, as applicable:
 - Notice Inviting Bids;
 - Instructions to Bidders;
 - Supplementary Instructions to Bidders;
 - Bid Proposal and Bid Bond;
 - Standard Specifications;
 - Supplementary Conditions;
 - Exhibits;
 - Insurance Requirements;
 - Labor and Material Payment Bond;
 - Performance Bond
 - Technical Specifications;

- List of Drawings;
- Drawings;
- Addenda;
- Notice to Proceed;
- Change Orders;
- Notice of Completion.

“Contract Documents” also includes all other documents identified in the Contract Documents which together form the contract between the City and the Contractor for the Work. The Contract Documents constitute the complete agreement between the City and the Contractor and supersede any previous agreements or understandings.

2. **CONTRACT SUM.** In consideration of the services rendered hereunder, the City shall pay the Contractor a sum not to exceed amount of _____ (\$ _____) for the Work in the manner set forth in the Contract Documents, in accordance with the prices set forth therein. Contractor shall provide City with a monthly invoice for current completed work. The City shall make payments within thirty-five (35) days after receipt of the Contractor’s undisputed and properly submitted invoice, including an updated schedule of work. The City shall return to the Contractor any invoice determined not to be a proper payment request as soon as practicable, but not later than seven (7) days after receipt and shall explain in writing the reasons why the payment request is not proper. Contractor shall have seven days from written notice of improper payment request to submit a revised request satisfactory to the City. Payment for a properly revised payment request shall then be paid by the City within a reasonable period thereafter.

3. **SECURITIES AND BONDS.** Within ten (10) working days of the Effective Date of this Contract, the Contractor shall furnish a labor and material payment bond in an amount equal to one hundred percent (100%) of the Contract Sum, and a faithful performance bond in the amount equal to one hundred percent (100%) of the Contract Sum. Said bonds shall be secured from a surety company admitted and authorized to do business in California as such and satisfactory to the City. Upon filing the Notice of Completion, the Contractor shall be required to maintain a labor and material payment bond for a period of seven (7) months. Additionally, the faithful performance bond amount shall be reduced to an amount equal to fifteen percent (15%) of the Contract Sum and shall remain in effect until the end of all warranty periods set forth in the Contract Documents, or, if no warranty period is specified, for a period of twelve (12) months after filing of the Notice of Completion. (Note: Securities are not required if Contract Sum is less than \$25,000.)

4. **INSURANCE.**
 - A. Before commencing performance under this Agreement, and at all other times this Agreement is effective, Contractor will procure and maintain the following types of insurance with coverage limits complying, at a minimum,

with the limits set forth below:

<u>Type of Insurance</u>	<u>Limits</u>
Commercial general liability:	\$2,000,000 per occurrence
Business automobile liability	\$1,000,000 per occurrence
Workers Compensation	Statutory Requirement (only if Contractor has employees)

**The city has the option to increase the limits as required for more complex and major waterworks, sanitation, and road pavement projects.*

- B. Commercial general liability (“CGL”) insurance must meet or exceed the requirements of ISO-CGL Form No. Form CG 00 01 04 13, or equivalent, covering CGL on an “occurrence” basis, including property damage, bodily injury and personal & advertising injury with limits no less than \$2,000,000 per occurrence. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location (ISO CG 25 03 or 25 04) or the general aggregate limit shall be twice the required occurrence limit.
- C. For automobiles, the insurance must meet or exceed the requirements of Insurance Services Office Form Number CA 0001 covering Code 1 (any auto), or, if Contractor provides proof of a personal automobile policy, such personal policy must include and indicate business venture coverage with limits no less than \$1,000,000 per accident for bodily injury and property damage. If Contractor has no owned autos, Code 8 (hired) and 9 (non-owned), with limits no less than \$1,000,000 per accident for bodily injury and property damage must be included in coverage.
- D. The amount of insurance set forth above will be a combined single limit per occurrence for bodily injury, personal injury, and property damage for the policy coverage. Liability policies will be endorsed to name City, its officials, and employees as “additional insureds” under said insurance coverage and to state that such insurance will be deemed “primary” such that any other insurance that may be carried by City will be excess thereto. City’s additional insured status will apply with respect to liability and defense of suits arising out of Contractor’s acts or omissions. Such insurance will be on an “occurrence,” not a “claims made,” basis and will not be cancelable or subject to reduction except upon thirty (30) days prior written notice to City, and the notice must include any necessary endorsement to facilitate such notice to City.

- E. Required Insurance Endorsement Language:
 - i. Additional Insured Endorsement with this language: “The City of El Segundo, its elected and appointed officials, employees, and volunteers as additional insureds.”
 - ii. Cancellation Endorsement with this language: “The City of El Segundo will receive thirty (30) days written notice in the event of cancellation, nonrenewed or reduction.”
 - iii. Primary and Non-Contributory Endorsement with this language: “Coverage is primary and non-contributory such that any other insurance that may be carried by the City will be excess thereto.”
- F. Contractor will furnish to City valid Certificates of Insurance evidencing maintenance of the insurance required under this Agreement, a copy of an Additional Insured endorsement confirming CITY has been given Additional Insured status under the Contractor’s General Liability policy, and such other evidence of insurance or copies of policies as may be reasonably required by City from time to time. Insurance must be placed with insurers with a current A.M. Best Company Rating equivalent to at least a Rating of “A:VII.”
- G. Should Contractor, for any reason, fail to obtain and maintain the insurance required by this Agreement, CITY may obtain such coverage at Contractor’s expense and deduct the cost of such insurance from payments due to Contractor under this Agreement or terminate pursuant to Section 7.

5. TIME FOR PERFORMANCE.

- A. The Contractor will fully complete the Work by _____ (“Project Completion Date”). The Contract Documents will supersede any conflicting provisions included on the Notice to Proceed issued pursuant to this Contract.
- B. The Contractor may not perform any Work until:
 - i. The Contractor furnishes proof of insurance as required by the Contract Documents; and
 - ii. The City gives the Contractor a written, signed, and numbered purchase order and Notice to Proceed.
- C. By signing this Contract, the Contractor represents to the City that the Project Completion Date is reasonable for completion of the Work and that the Contractor will complete the Work by that date.

- D. Should the Contractor begin the Work before receiving written authorization to proceed, any such Work is at the Contractor's own cost and risk.

6. DELAYS AND EXTENSIONS OF TIME.

- A. General. Unless otherwise agreed in writing, an adjustment to the Project Completion Date by reason of a Change Order shall be agreed to at the time the Change Order is issued and accepted by Contractor.
- B. Extensions of Time. In the event it is deemed appropriate by the City to extend the time for completion of the Work, any such extension shall not release any guarantee for the Work required by the Contract Documents, nor shall any such extension of time relieve or release the Sureties on the Bonds executed. In executing such Bonds, the Sureties shall be deemed to have expressly agrees to any such extensions of time. The amount of time allowed by an extension of time shall be limited to the period of the delay giving rise to the same as determined by the City. Notwithstanding any dispute which may arise in connection with a claim for adjustment of the Project Completion Date, the Contractor shall promptly proceed with the Work.
- C. Payment for Delays. Notwithstanding any other terms and conditions of the Contract Documents, the City shall have no obligation whatsoever to increase the Contract Sum or extend the time for delays. Unless compensation and/or markup is agreed upon by the City, the Contractor agrees that no payment of compensation of any kind shall be made to the Contractor for damages or increased overhead costs caused by any delays in the progress of the Contract, whether such delays are avoidable or unavoidable or caused by any act or omission of the City or its agents. Any accepted delay claim shall be fully compensated for by an extension of time to complete the performance of the Work.

- 7. **TERM AND TERMINATION.** The Contract is effective as of the Effective Date stated in the first paragraph of this Contract and shall remain in full force and effect until the Contractor has fully rendered the services required by the Contract Documents or the Contract has been otherwise terminated by the City. However, some provisions may survive the term of the Contract, as stated in those provisions.

City may terminate this Contract at any time, at will, for any reason or no reason, after giving written notice to Contractor at least ten (10) calendar days before the termination is to be effective. If City defaults under this Agreement, and if City has not cured the default within thirty (30) calendar days after Contractor has given City notice of the event of default. Contractor may terminate this Contract for cause after giving written notice to City at least thirty (30) calendar days before the termination is to be effective. Contractor shall cease all work under this Contract on or before the effective

date of termination specified in the notice of termination. Contractor shall be paid for services satisfactorily rendered to the last working day this Contract is in effect and Contractor shall deliver all materials, reports, documents, notes or other written materials compiled through the last working day this Contract is in effect. In no event shall Contractor be entitled to receive more than the maximum compensation set forth in this Contract that would be paid to the Contractor for the full performance of the services required by this Contract. Neither party shall have any other claim against the other party by reason of such termination. In the event the City terminates the Contract, Contractor shall be reimbursed for all unavoidable and unmitigable costs resulting from such termination, in addition to the compensation for all work completed up until the effective date of the termination of the Contract.

- 8. PERMITS AND LICENSES.** Before starting any construction work, the Contractor will be required to obtain all necessary permits, licenses or certificates from the City and shall maintain such permits, licenses and certificates required to complete the Work until the Project Completion Date. Contractor shall bear all costs for fees for all agencies except for the City's permit fees.
- 9. COOPERATION AND COLLATERAL WORK.** The Contractor shall be responsible for coordinating all Work with the City's Street sweeping, trash pick-up, and street maintenance contractors, emergency services departments, utility company crews, and others when necessary. Payment for conforming to these requirements shall be included in other items of Work, and no additional payment shall be made thereof.
- 10. EXTRA WORK.** New and unforeseen work will be classified as Extra Work only when the Work is not covered and cannot be paid for under any of the various items or combination of items for which a Bid price appears on the Bid. The Contractor shall not do any Extra Work except upon written order from the City Manager.
- 11. ASSIGNMENT.** Any purported assignment without written consent of the City shall be null, void, and of no effect, and the Contractor shall hold harmless, defend and indemnify the City and its officers, officials, employees, agents and representatives with respect to any claim, demand, or action arising from or relating to any unauthorized assignment.

If the city opts to consent to assignment, the City's consent shall be contingent upon: (1) a letter from the Surety agreeing to the assignment and assigning all of the Bonds to the assignee without any reduction, or the assignee supplying all new Bonds in the amounts originally required under the Contract Documents; and (2) the assignee supplying all of the required insurance in the amounts required in the Contract Documents. Until the Surety assigns all of the Bonds or the assignee supplies all of the new Bonds, and until the assignee supplies all of the required insurance, an assignment otherwise consented to in writing by the City shall not be effective. Even if the City consents to assignment, no assignment shall relieve the Contractor from liability under the Contract.

12. INSPECTION. The Contractor shall arrange and pay for all off-site inspection of the Work required by any ordinance or governing authorities. The Contractor shall also arrange and pay for other inspections, including tests in connection therewith, as may be assigned or required.

13. WORKSITE MAINTENANCE.

- A. General. Clean-up shall be done as Work progresses at the end of each day and thoroughly before weekends. The Contractor shall not allow the Work site to become littered with trash and waste material but shall maintain the same in a neat and orderly condition throughout the construction operation. Materials which need to be disposed shall not be stored at the Work site but shall be removed by the end of each working day. If the job site is not cleaned to the satisfaction of the City Manager, the cleaning will be done or contracted by the City and shall be back-charged to the Contractor and deducted from the Contract Sum.

The Contractor shall promptly remove from the vicinity of the completed Work, all rubbish, debris, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by the City will be withheld until the Contractor has satisfactorily complies with the foregoing requirements for final clean-up of the Work site.

- B. Storage of Equipment and Materials. The Contractor shall make arrangements for storing its equipment and materials. The Contractor shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the Work. Approved areas within Work site may be used for temporary storage; however, the Contractor shall be responsible for obtaining any necessary permits from the City. Construction materials and equipment shall not be stored in streets, roads, or highways unless otherwise approved by the City Manager.
- C. All costs associated with the clean-up and storage required to complete the Work shall be the sole responsibility of the Contractor.

14. WARRANTY. For purposes of the calculation of the start of the warranty period, the Work shall be deemed completed upon the date of the Notice of Completion. If that direction is contingent on the completion of any items remaining on a punch list, the Work shall be deemed to be completed upon the date of the City Manager's acceptance of the final item(s) on the punch list. The Contractor shall repair or replace defective materials and workmanship at its own expense. Additionally, the Contractor agrees to defend, indemnify, and hold harmless the City from claims or any kind arising from damage, injury, or death due to such defects. The parties agree that no certificates given shall be conclusive evidence of the faithful performance of the Contract, either in whole or in part, and that no payment shall be construed to be in acceptance of any

defective Work or improper materials. Further, the certificate or final payment shall not terminate the Contractor's obligations under the warranty herein.

- 15. CONTRACTOR'S RESPONSIBILITY FOR WORK.** Until the final acceptance of the Work by the City, the Contractor shall have the charge and care thereof and shall bear the risk of injury or damage to any part of the Work by the action of the elements, criminal acts, or any other cause. The Contractor shall rebuild, repair, restore and make good all injuries or damages to any portion of the Work occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except for such injuries or damages arising from the sole negligence or willful misconduct of the City, its officers, agents or employees. In the case of suspension of Work from any cause whatsoever, the Contractor shall be responsible for all materials and the protection of Work already completed, shall properly store and protect them if necessary, and shall provide suitable drainage and erect temporary structures where necessary. The Contractor is prohibited from performing work with a subcontractor who is debarred pursuant to Labor Code §§ 1777.1 or 1777.7.
- 16. DISPUTES.** Disputes arising from this contract will be determined in accordance with the Contract Documents and Public Contracts Code §§ 10240-10240.13.
- 17. THIRD PARTY CLAIMS.** In accordance with Public Contracts Code § 9201, the City will promptly inform the Contractor regarding third-party claims against the Contractor, but in no event later than 10 business days after the City receives such claims. Such notification will be in writing and forwarded in accordance with the "Notice" section of the Contract Documents. As more specifically detailed in the Contract Documents, the Contractor agrees to indemnify and defend the City against any third- party claim.
- 18. TAXPAYER IDENTIFICATION NUMBER.** The Contractor will provide the City with a Taxpayer Identification Number.
- 19. OWNERSHIP OF DOCUMENTS.** All documents, data, studies, drawings, maps, models, photographs and reports prepared by the Contractor under the Contract Documents are the City's property. The Contractor may retain copies of said documents and materials as desired, but will deliver all original materials to the City upon the City's written notice.
- 20. INDEMNIFICATION.** To the maximum extent permitted by law, the Contractor hereby agrees at its sole cost and expense, to defend, protect, indemnify, and hold harmless the City, its elected and appointed officials, officers, employees, volunteers, attorneys, agents (including those City agents serving as independent contractors in the role of City representative), successors, and assignees (collectively "Indemnitees") from and against any and all claims (including, without limitation, claims for bodily injury, death or damage to property), demands, charges, obligations, damages, causes of action, proceedings, suits, losses, stop payment notices, judgments, fines, liens, penalties, liabilities, costs and expenses of every kind and nature whatsoever, in any

manner arising out of, incident to, related to, in connection with or resulting from any act, failure to act, error or omission of the Contractor or any of its officers, agents, attorneys, employees, subcontractors, material supplies or any of their officers, agents or employees and/or arising out of, incident to, related to, in connection with or resulting from any term, provision, image, plan, covenant, or condition in the Contract Documents, including, without limitation, the payment of all consequential damages, attorneys' fees, experts' fees, and other related costs and expenses (individually a "Claim", or collectively, "Claims"). The Contractor shall promptly pay and satisfy any judgment, award or decree that may be rendered against any of the Indemnitees as to any such Claim. The Contractor shall reimburse Indemnitees for any and all legal expenses and costs incurred by each of them in connection therewith or in enforcing the indemnity herein provided. The Contractor's obligation to indemnify shall not be restricted to insurance proceeds, if any, received by the Contractor or Indemnitees. This indemnity shall apply to all claims regardless of whether any insurance policies are applicable or whether the Claim was caused in part or contributed to by an Indemnatee.

Nonwaiver of Rights. Indemnitees do not and shall not waive any rights that they may possess against the Contractor because the acceptance by the City or the deposit with the city of any insurance policy or certificate required pursuant to these Contract Documents. This indemnity provision is effective regardless of any prior, concurrent, or subsequent active or passive negligence by Indemnitees and shall operate to fully indemnify Indemnitees against any such negligence.

Waiver of Right of Subrogation. The Contractor, on behalf of itself and all parties claiming under or through it, hereby waives all rights of subrogation and contribution against the Indemnitees, while acting within the scope of their duties, from all Claims arising out of or incident to the activities or operations performed by or on behalf of the Contractor regardless of any prior, concurrent or subsequent active or passive negligence by Indemnitees.

Survival. The provisions of this Section 20 shall survive the term and termination of the Contract, are intended to be as broad and inclusive as is permitted by the law of the State, and are in addition to any other rights or remedies that Indemnitees may have under the law. Payment is not required as a condition precedent to an Indemnitee's right to recover under this indemnity provision, and an entry of judgment against the Contractor shall be conclusive in favor of the Indemnitee's right to recover under this indemnity provision.

- 21. NONDISCRIMINATORY EMPLOYMENT.** The Contractor shall not unlawfully discriminate against any individual based on race, religion, creed, color, national origin, ancestry, physical disability, mental disability, medical condition, genetic information, marital status, sex, gender identity, gender expression, age, sexual orientation, or military and veteran status. The Contractor understands and agrees that it is bound by and will comply with the nondiscrimination mandates of all statutes and local ordinances and regulations.

- 22. PREVAILING WAGES.** In accordance with Labor Code § 1770 et seq., the Project is a “public work” to which prevailing wages apply. The Contractor and any Subcontractors shall pay wages in accordance with the determination of the Director of the Department of Industrial Relations (“DIR”) regarding the prevailing wage rate of per diem wages. The Contractor shall post a copy of the DIR’s determination of the prevailing rate of per diem wages at each job site. The project is subject to compliance monitoring and enforcement by the DIR.
- 23. INDEPENDENT CONTRACTOR.** The City and the Contractor agree that the Contractor will act as an independent contractor and will have control of all work and the manner in which it is performed. The Contractor will be free to contract for similar service to be performed for other employers while under contract with the City. The Contractor is not an agent or employee of the City and is not entitled to participate in any pension plan, insurance, bonus or similar benefits the City provides for its employees. Any provision in this Contract that may appear to give the City the right to direct the Contractor as to the details of doing the work or to exercise a measure of control over the work means that the Contractor will follow the direction of the City as to end results of the work only.
- 24. CONFLICTS OF INTEREST.** Contractor and its employees, associates and subcontractors, if any, shall comply with all California conflict of interest statutes applicable to Contractor’s Work under this Contract, including, but not limited to the Political Reform Act (Gov. Code § 81000 et seq.) and Government Code § 1090.
- 25. AUDIT OF RECORDS.** The Contractor will maintain full and accurate records with respect to all services and matters covered under this Contract. The City will have free access at all reasonable times to such records, and the right to examine and audit the same and to make transcript therefrom, and to inspect all program data, documents, proceedings and activities. The Contractor will retain such financial and program service records for at least three years after termination or final payment under the Contract Documents.
- 26. NON-WAIVER OF TERMS, RIGHTS AND REMEDIES.** Waiver by either party of any one or more of the conditions of performance under the Contract Documents shall not be a waiver of any other condition of performance under the Contract Documents. In no event shall the making by the City of any payment to the Contractor constitute or be construed as a waiver by the City of any breach of covenant, or any default that may then exist on the part of the Contractor, and the making of any such payment by the City shall in no way impair or prejudice any right or remedy available to the City with regard to such breach or default.
- 27. NOTICES.** All communications to either party by the other party will be deemed made when received by such party at its respective name and address as follows:

To Contractor:

To City:

Attn: _____
Dept.: _____
Address: _____
Phone: _____
Email: _____

Attn: _____
Dept.: _____
Address: _____
Phone: _____
Email: _____

Any such written communications by mail will be conclusively deemed to have been received by the addressee upon deposit thereof in the United States Mail, postage prepaid and properly addressed as noted above. In all other instances, notices will be deemed given at the time of actual delivery. Changes may be made in the names or addresses of persons to whom notices are to be given by giving notice in the manner prescribed in this paragraph.

- 28. NO THIRD PARTY BENEFICIARY.** This Contract and every provision herein is for the exclusive benefit of the Contractor and the City and not for the benefit of any other party. There will be no incidental or other beneficiaries of any of the Contractor's or the City's obligations under this Contract.
- 29. INTERPRETATION.** This Contract was drafted in, and will be construed in accordance with the laws of the State of California, and exclusive venue for any action involving this Contract will be in Los Angeles County.
- 30. EFFECT OF CONFLICT.** In the event of any conflict, inconsistency, or incongruity between any provision of the Contract Documents, precedence will be as determined in the Standard Specifications.
- 31. SEVERABILITY.** If any portion of the Contract Documents are declared by a court of competent jurisdiction to be invalid or unenforceable, then such portion will be deemed modified to the extent necessary in the opinion of the court to render such portion enforceable and, as so modified, such portion and the balance of this Contract will continue in full force and effect.
- 32. AUTHORITY/MODIFICATION.** The Parties represent and warrant that all necessary action has been taken by the Parties to authorize the undersigned to execute this Contract and to engage in the actions described herein. This Contract may be modified by written amendment. The City's city manager, or designee, may execute any such amendment on the City's behalf.
- 33. ENTIRE AGREEMENT.** This Contract, including the Contract Documents and any other documents incorporated herein by specific reference, represents the entire and integrated agreement between City and Contractor. This Contract supersedes all prior oral or written negotiations, representations or agreements. This Contract may not be modified or amended, not any provisions or breach waived, except in a writing signed by both parties that expressly refers to this Contract.

34. ELECTRONIC SIGNATURES; SIGNATURE AUTHORITY. This Contract may be executed by the Parties on any number of separate counterparts, and all such counterparts so executed constitute one agreement binding on all the Parties notwithstanding that all the Parties are not signatories to the same counterpart. In accordance with Government Code §16.5, the Parties agree that this Contract, agreements ancillary to this Contract, and related documents to be entered into in connection with this Contract will be considered signed when the signature of a party is delivered by electronic transmission. Such electronic signature will be treated in all respects as having the same effect as an original signature. Contractor warrants that its signatory (or signatories, as applicable) to this Agreement has the legal authority to enter this Agreement and bind Contractor accordingly.

35. COVENANTS AND CONDITIONS. The parties agree that all of the provisions hereof will be construed as both covenants and conditions, the same as if the words importing such covenants and conditions had been used in each separate paragraph.

36. CAPTIONS. The captions of the paragraphs of this Contract are for convenience of reference only and will not affect the interpretation of this Contract.

37. TIME IS OF ESSENCE. Time is of the essence for each and every provision of the Contract Documents.

[Signatures on following page.]

IN WITNESS WHEREOF the parties hereto have executed this Contract the day and year first hereinabove written.

CITY OF EL SEGUNDO

CONTRACTOR

Darrell George,
City Manager

Name:
Title:

Name:
Title:

Taxpayer ID No.

Contractor State License No.

Contractor City Business License No.

ATTEST:

Susan Truax,
City Clerk

APPROVED AS TO FORM:
MARK D. HENSLEY, City Attorney

By: _____
David King, Assistant City Attorney

FAITHFUL PERFORMANCE BOND

**RECREATION PARK TEEN CENTER, PLAZA, AND SKATEPARK
RENOVATION PROJECT
PROJECT NO.: PW #25-13**

Bond No.

Bond Fee:

_____ (“PRINCIPAL”)

and _____, a
corporation

incorporated under the laws of the State of _____ and licensed by the State of California to execute bonds and undertakings as sole surety, as surety (“SURETY”), are held and firmly bound unto the CITY OF EL SEGUNDO (“CITY”) in the sum of _____ **DOLLARS** and _____ cents (\$ _____), lawful money of the United States, which may be increased or decreased by a rider hereto executed in the same manner as this bond, for the payment of which sum PRINCIPAL and SURETY bind themselves, their successors, and assigns, jointly and severally, by this instrument.

PRINCIPAL or SURETY will apply this bond for the faithful performance of any and all of the conditions and stipulations set forth in this bond, **SPECIFICATIONS NO. PW 25-13**, and the Public Works contract executed with such Specifications. In the case of any default in the performance of the conditions and stipulations of this undertaking, it is agreed that PRINCIPAL or SURETY will apply the bond or any portion thereof, to the satisfaction of any damages, reclamation, assessments, penalties, or deficiencies arising by reason of such default.

BOND CONDITIONS

1. PRINCIPAL will construct the public improvements identified in **SPECIFICATIONS NO. PW 25-13**, a copy of which is on file with CITY’s Engineering Division (“Public Project”). Such performance will be in accordance with CITY’s plans and profiles (**CITY DRAWING FILE NO. PW 25-13**) which are made a part of this bond when said plans and profiles are approved by the City Council and filed with CITY’s Engineering Division. CITY has estimated the required amount of the bond as shown above.

2. PRINCIPAL’s work on the Public Project will be done in accordance with CITY’s plans and specifications and with any permit issued by CITY. Should PRINCIPAL fail to complete all required work within the time allowed, CITY may, at its sole discretion, cause all required work to be done and the parties executing the bond will be firmly bound for the payment of all necessary costs therefor.

3. PRINCIPAL will guarantee its work against any defective work, labor, or materials on the Public Project for a period of one (1) year following the Public Project's completion and acceptance by CITY. Should PRINCIPAL fail to correct its work against any defective work, labor, or materials, CITY may, at its sole discretion, cause all required work to be done and the parties executing the bond will be firmly bound for the payment of all necessary costs therefor.

4. This bond is conditioned upon and guarantees due compliance with all applicable law including, without limitation, the El Segundo Municipal Code ("ESMC").

5. SURETY, for value received, agrees that no changes, extensions of time, alteration or modification of **SPECIFICATIONS NO. PW 25-13** or of the obligation to be performed will in any way affect its obligation on this bond, and it waives notice of any such change, extension of time, alteration or modification of the contract documents or of the obligation to be performed.

6. This bond consists of this instrument; the plans and specifications identified above; and the following two (2) attached exhibits all of which are incorporated herein by reference:

- A. A certified copy of the appointment, power of attorney, bylaws or other instrument entitling or authorizing the persons executing this bond to do so;
- B. A certificate issued by the county clerk for the county in which SURETY's representative is located conforming with California Code of Civil Procedure § 995.640 and stating that SURETY's certificate of authority has not been surrendered, revoked, cancelled, annulled, or suspended, or in the event that it has, that renewed authority has been granted; and

7. Should PRINCIPAL perform its obligations within the time allowed, PRINCIPAL's obligation will be void one (1) year following the acceptance of the performance by CITY; otherwise this obligation will remain in full force and effect.

[SIGNATURES ON FOLLOWING PAGE]

SIGNED AND SEALED this _____ day of _____, 20____.

PRINCIPAL's PRESIDENT

SURETY's PRESIDENT

PRINCIPAL's SECRETARY

SURETY's SECRETARY

**PRINCIPAL's
ADDRESS:**

MAILING

SURETY's MAILING ADDRESS:

NOTE:

- (1) ALL signatures must be acknowledged by a notary public.
Return one (1) original to City Clerk's Office.
- (2) Bond shall be effective for one (1) year after acceptance of the job.

LABOR AND MATERIALS BOND

RECREATION PARK TEEN CENTER, PLAZA AND SKATEPARK RENOVATION PROJECT PROJECT NO.: PW #25-13

Bond No.

Bond Fee:

_____, as principal

("PRINCIPAL") and _____, a
corporation

incorporated under the laws of the State of _____ and licensed by the
State of California to execute bonds and undertakings as sole surety, as surety ("SURETY"),
are held and firmly bound unto the CITY OF EL SEGUNDO ("CITY") in the sum of
_____ **DOLLARS** and _____ cents
(\$ _____), lawful money of the United States, which may be increased or decreased
by a rider hereto executed in the same manner as this bond, for the payment of which sum
PRINCIPAL and SURETY bind themselves, their successors, and assigns, jointly and
severally, by this instrument.

This bond is conditioned upon and guarantees payment by PRINCIPAL to contractors,
subcontractors, and persons renting equipment; payment by PRINCIPAL and all
PRINCIPAL'S subcontractors for all materials, provisions, provender, or other supplies, and
equipment used in, upon, for or about the performance of the work contemplated in
SPECIFICATIONS NO. PW 25-13 ("Public Project"), the Public Works contract executed
for such Public Project, and for all work or labor of any kind performed for the Public
Project. In the case of any default in the performance of the conditions and stipulations of
this undertaking, it is agreed that PRINCIPAL or SURETY will apply the bond or any
portion thereof, to the satisfaction of any damages, reclamation, assessments, penalties, or
deficiencies arising by reason of such default.

BOND CONDITIONS

1. PRINCIPAL will construct the public improvements identified in
SPECIFICATIONS NO. PW 25-13, and the Public Works contract executed for such
Specifications, copies of which is on file with CITY's Engineering Division ("Public
Project"). Such performance will be in accordance with CITY's plans and profiles (**CITY
DRAWING FILE NO. PW 25-13**), which are made a part of this bond when said plans and
profiles are approved by the City Council and filed with CITY's Engineering Division.

2. PRINCIPAL will pay all contractors, subcontractors, and persons renting
equipment.

3. PRINCIPAL will pay for all materials and other supplies, for equipment used in, on, for or about the performance of the Public Project, and will pay for all work and labor thereon.

4. This bond is conditioned upon and guarantees due compliance with all applicable law including, without limitation, the El Segundo Municipal Code (“ESMC”).

5. SURETY, for value received, agrees that no changes, extensions of time, alteration or modification of **SPECIFICATIONS NO. PW 25-13**, or of the obligation to be performed will in any way affect its obligation on this bond, and it waives notice of any such change, extension of time, alteration or modification of the contract documents or of the obligation to be performed.

6. This bond consists of this instrument; the plans and specifications identified above; and the following TWO (2) attached exhibits all of which are incorporated herein by reference:

- A. A certified copy of the appointment, power of attorney, bylaws or other instrument entitling or authorizing the persons executing this bond to do so; and
- B. A certificate issued by the county clerk for the county in which SURETY’s representative is located conforming with California Code of Civil Procedure § 995.640 and stating that SURETY’s certificate of authority has not been surrendered, revoked, cancelled, annulled, or suspended, or in the event that it has, that renewed authority has been granted.

7. Should PRINCIPAL perform its obligations within the time allowed, PRINCIPAL’s obligation will be void upon the acceptance of the performance by CITY; otherwise this obligation will remain in full force and effect.

[SIGNATURES ON FOLLOWING PAGE]

SIGNED AND SEALED this _____ day of _____, 20____.

PRINCIPAL's PRESIDENT

SURETY's PRESIDENT

PRINCIPAL's SECRETARY

SURETY's SECRETARY

PRINCIPAL's MAILING ADDRESS:

SURETY's MAILING ADDRESS:

NOTE: (1) ALL signatures must be acknowledged by a notary public.
Return one (1) original to City Clerk's Office.

SECTION II - GENERAL REQUIREMENTS

CITY OF EL SEGUNDO PUBLIC WORKS DEPARTMENT

GENERAL SPECIFICATIONS

1. REGISTRATION OF CONTRACTORS

No bid will be accepted from a **Contractor** who has not been licensed in accordance with the provisions of the laws of the State of California relating to licensing of contractors, for the type of work to be performed under this Contract.

2. INSURANCE AND CITY BUSINESS LICENSE

Contractor and **Subcontractors** will obtain appropriate insurance and a City Business License before execution of the construction contract.

3. EMERGENCY INFORMATION

The names, addresses and telephone numbers of the **Contractor** and **Subcontractors**, or their representatives, will be filed with the City Engineer and the City Police Department **BEFORE PERFORMING WORK.**

4. FURNISHING OF WATER

Water necessary for the prosecution of the work as herein specified will be furnished by the City in the following manner:

The **Contractor** will deposit with the City Water/Wastewater Division the sum of **One Thousand Four Hundred Forty-Four Dollars (\$1,444.00)** to insure against damage to a 2 ½" Fire Hydrant water meter, which will be furnished and installed by the City at a point convenient to the site of the work. This deposit will be refunded to the **Contractor** upon completion of the Project if, after removal and inspection of said meter by the City, it is found to be in satisfactory condition. In event of damage to this meter while under the jurisdiction of the **Contractor**, all or any part of said deposit may be retained by the City.

A non-refundable Activation Fee of **One Hundred and Fifty-Six Dollars (\$156.00)** will be charged to the **Contractor** upon activation of the temporary meter. All water used from the temporary meter will be metered and charged to the **Contractor** at the prevailing rate plus the current daily meter rental rate. The **Contractor** will be charged a \$15 reconnect fee if the **Contractor** wishes the City to relocate the temporary meter to another hydrant.

Cost of water to be used shall be included in the Contract bid price of the items of work relevant to its use.

5. CALIFORNIA - OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION

All work performed under this contract will be done in strict compliance with the Cal-OSHA Rules and Regulations, latest edition.

6. SOUND CONTROL

The **Contractor** will comply with all local sound control and noise level rules, regulations and ordinances that apply to any work performed pursuant to the contract.

Each internal combustion engine, used for any purpose on the Project or related to the Project, will be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine will be operated on the Project without said muffler.

The use of loud signals will be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

7. AIR POLLUTION CONTROL

The Contractor is put on notice that he must abide by all existing rules and regulations of the SCAQMD (South Coast Air Quality Management District), relating to all operations or equipment which discharge visible emissions or solid or liquid particles to the atmosphere.

8. WORKER UNIFORMS

All workers under the employment of the **Contractor** or his/her **Subcontractor** shall wear the appropriate safety apparel as required by the latest edition of the Work Area Traffic Control Handbook (WATCHBOOK) while working in the public right-of way. Workers shall wear the correct Class visibility apparel for the speed zone working in, as required in the WATCHBOOK.

**CITY OF EL SEGUNDO
PUBLIC WORKS DEPARTMENT**

SUPPLEMENTAL PROVISIONS

**PART 1
GENERAL PROVISIONS**

SECTION 1 - GENERAL

0-0 STANDARD SPECIFICATIONS

0-1 GENERAL

Except as modified by these Supplemental Provisions, the provisions of the latest edition of the "Standard Specifications for Public Works Construction" ("Greenbook") and its supplements prepared and promulgated by Public Works Standards, Inc. Public Works, constitute the Standard Specifications for this Project.

0-2 NUMBERING OF SECTIONS

The numbering contained within the Standard Specifications of the Contract Documents is intended to correspond with Greenbook numbering.

1-2 TERMS AND DEFINITIONS

Add or delete the following to Subsection 1-2 of the Greenbook.

Acceptance – In the context of “acceptance” of the work, the date on which the *City Council* accepts the Work as complete.

City - City of El Segundo

City Council - The body constituting the awarding authority of the City.

Compensable Delay - a delay entitling the Contractor to an adjustment of the Contract Sum and an adjustment of the Contract Time in accordance with this Agreement.

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) before the commencement of the contemplated action. Notification may be from Engineer to Contractor or from Contractor to Engineer.

Engineer - The City Engineer, or designee, as defined in the Greenbook. Unless otherwise provided, all correspondence and decisions made relative to the contract will be by the City Engineer or his designated representative.

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

Public Works Director – The City’s Public Works Director, or designee.

State Standard Specifications - State of California Standard Specifications, latest edition and supplements, California State Transportation Agency, Department of Transportation (Caltrans)

Working Days - A working day is defined as any day, except Saturdays, Sundays, legal holidays and days when work is suspended by the Engineer (non-working), as provided in Subsection **6-3 TIME OF COMPLETION**.

1-3 ABBREVIATIONS

Add the following to Subsection 1-3 of the Greenbook.

1-3.1 Common Usage

Public Works	Public Works
NTP	Notice to Proceed
WATCH	Work Area Traffic Control Handbook
SSPWC	Standard Specifications for Public Works Construction by Public Works Standards, Inc.
CITY	City of El Segundo

1-3.2 Institutions

AAN	American Association of Nurserymen
AGC	Associated General Contractors of America
AISC	American Institute of Steel Construction
APWA	American Public Works Association
ASA	American Standard Association
ASME	American Society of Mechanical Engineers
IEEE	Institute of Electric and Electronic Engineers
NEC	National Electric Code
PCC	California Public Contract Code

1-6 BIDDING AND SUBMISSION OF THE BID

Subsection 1-6 Bidding and Submission of the Bid of Greenbook is deleted in its entirety and replaced with the following subsection.

1-6.1 General

Except as provided in PCC §§ 4100 et. seq., each bidder will file with its bid the name and location of the place of business of each subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to the prime contractor, specifically fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of one percent of the prime contractor's total bid. Only one subcontractor will be listed for each portion of the work, which portion will be defined in the bid. In each instance, the nature and extent of the work to be sublet will be described. The failure of the Contractor to specify a subcontractor, or the listing of more than one subcontractor for the same portion of the work, constitutes an agreement by the Contractor that it is fully qualified to perform that portion itself and that it will perform that portion itself.

The Contractor must have the City Council's written consent to substitute a subcontractor other than that designated in the original bid, to permit any subcontract to be assigned or transferred, or to allow a subcontract to be performed by other than the original subcontractor.

Subcontracting of work for which no subcontractor was designated in the original bid, and which is more than one-half of one percent of the work, will be allowed only in cases of public emergency or necessity, and then only after a finding reduced to writing as a public record of the City Council setting forth the facts constituting the emergency or necessity.

Violation of any of the above provisions will be considered a breach of the Contract, and the City may terminate the Contractor's control over the Work, cancel the contract, or assess the Contractor a penalty of not more than ten percent of the subcontract involved.

All persons engaged in the work, including subcontractors and their employees will be considered as employees of the Contractor. The Contractor will be solely responsible for and have control over construction means, methods, techniques, sequences, procedures, and the coordination of all portions of the Work. The City will deal directly with, and make all payments to, the prime Contractor.

When subcontracted work is not being prosecuted in a satisfactory manner, the Contractor will be notified to take corrective action. The Engineer may report the facts to the City Council. If the City Council so orders, and on receipt by the

Contractor of written instructions from the Engineer, the subcontractor will be removed immediately from the Work. That subcontractor will not again be employed on the Work.

If licensure or proper licensure is controverted, then proof of licensure pursuant to this section must be made by production of a verified certificate of licensure from the Contractors' State License Board which establishes that the individual or entity bringing the action was duly licensed in the proper classification of contractors at all times during the performance of any act or contract covered by the action. Nothing in this subdivision requires any person or entity controverting licensure or proper licensure to produce a verified certificate. When licensure or proper licensure is controverted, the burden of proof to establish licensure or proper licensure is on the licensee.

1-6.3 Additional Responsibility

Add the following to Subsection 1-6.2 Additional Responsibility:

The Contractor will submit experience statements for each subcontractor who will perform contract work that amounts to more than ten percent (10%) of the Work.

1-7 AWARD AND EXECUTION OF THE CONTRACT

1-7.2 Contract Bonds

Delete Paragraph four (4) of the Subsection and insert:

The "Performance Bond" shall be for 100% of the Contract Price to guaranty faithful performance of all work, within the time prescribed, in a manner satisfactory to the City, and that all materials and workmanship will be free from original or developed defects. The Faithful Performance Bond and the Labor and Materials Bond must be paid and in effect for one year after the acceptance of the job by the City in accordance with the guarantee required by Subsection 3-13.1.

SECTION 2 – SCOPE OF THE WORK

2.1 WORK TO BE DONE

Add following subsections:

2-1.1 Access to Project Site

Not later than the date designated in the City's Notice to Proceed (NTP), the City will provide access to the real property and facilities upon which the Work is to be performed, in accordance to the Contract Documents for the Contractor's use.

2-1.2 Ownership and Use of Contract Documents

The Contract Documents and all copies furnished to or provided by the Contractor are the City's property and may not be used for other work.

2-2 PERMITS

Add the following paragraph to Subsection 2-2:

The Contractor will apply for permits required by the City. These permits will be issued on a "no-fee" basis.

The Contractor must pay for and obtain all other permits from other governmental and utility agencies necessitated by their operations.

All bonding fees, permit, inspection permit fees or other fees, such as, but limited to, overweight and oversized vehicle permit fees, charges and/or required for the completion of the Contract Work must be paid by the Contractor. These costs shall be included in the bid item provided. If no bid item is included, costs will be included in the various items of work, and no additional payment will be allowed.

2-3 RIGHT-OF-WAY

Add the following subsection to Subsection 2-3:

2-3.1 Additional Work Areas and Facilities

When the Contractor arranges for additional temporary work areas and facilities, the Contractor will provide the City with proof that the additional areas or facilities have been left in a condition satisfactory to the owner(s) of said work areas or facilities before acceptance of the work.

2-9 CHANGED CONDITIONS.

Delete Subsection 2-9 and replace with the following:

If the Contractor encounters concealed or unknown conditions that differ materially from those anticipated or expected ("changed conditions"), the Contractor will *immediately* notify the Engineer in writing of such changed conditions (upon discovery and before disturbing such changed conditions), as provided in Subsection 6-11 of these Supplemental Provisions, so that the Engineer can determine if such conditions require design details that differ from those design details shown in the Contract Documents. Notwithstanding the time period (thirty (30) days) set forth in Subsection 6-11.3, Claims Submitted to Engineer, the Contractor is liable to the City for any extra costs incurred as a result of the Contractor's failure to promptly give such notice.

Changed conditions include, without limitation, the following:

1. Subsurface or latent physical conditions differing materially from those represented in the Contract Documents;
2. Unknown physical conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character being performed; and
3. Material differing from what is represented in the Contract which the Contractor believes may be hazardous waste as defined in California Health & Safety Code §25117 that is required to be removed to a Class I, II, or III disposal site in accordance with applicable law(s).

The Engineer will promptly investigate conditions that appear to be changed conditions and render a decision promptly. The Engineer's decision, and any dispute regarding that decision, will be made in accordance with Section 6-11, DISPUTES AND CLAIMS; PROCEDURE (of these Supplemental Provisions).

Any information provided pursuant to INFORMATION AVAILABLE TO BIDDERS is subject to the following provisions:

1. The information is made available for the Bidders' convenience and *is not a part* of the Contract.
2. The City has not determined the accuracy or completeness of such information and all such information is made available to Bidders without any representation or warranty by the City whatsoever as to its accuracy, completeness, or relevancy.
3. Bidders will independently evaluate such information for their use and will be solely responsible for use or interpretation of such information. Any such use or interpretation will not be the basis of any claim against the City.

2-10 DISPUTED WORK

Delete Subsection 2-10 and replace with the following:

If the Contractor and the City do not reach agreement on disputed work, the City may direct the Contractor to proceed with the work. Any payment for the disputed work will be determined pursuant to the claims procedures in these Supplemental Provisions. Although not to be construed as proceeding under extra work provisions, the Contractor will keep and furnish records of disputed work as required by the Contract Document.

SECTION 3 – CONTROL OF THE WORK

3-7 CONTRACT DOCUMENTS

Delete Subsection 3-7.1 and replace with the following: subsection.

3-7.1 General

The Contractor will maintain the following at the Work site:

1. Maintain one (1) as-built copy of the Project Plans and Specifications, in good order, complete and current with, clearly defined markings, to record all approved changes and selections made during construction. The As-built plans must be submitted to the City representative for approval before the City pays a final retention amount.
2. The current accepted Contract Schedule.
3. Shop Drawings, Product Data, and Samples. Copy of approved change documents (RFI, submittal, designer supplemental instructions and approved change orders, this is a partial listing of actual change documents, titles may vary from Project to Project).
4. All approved permits, including those issued by other agencies. Cal-OSHA permits for trench shoring shall be available for review on site, when requested.
5. All other required submittals.

The Plans, Specifications, and other Contract Documents will govern the Work. The Contract Documents are intended to be complementary and cooperative and to describe and provide for a complete project. Anything in the Specifications and not on the Plans, or on the Plans and not in the Specifications, will be as though shown or mentioned in both.

Payment for any items on the plans for which there is no specific bid item will be included in the various items of work or in any item to which it is appurtenant.

If the Contractor performs any work which it knows or should know involves an error, inconsistency, or omission without notifying and obtaining written consent from the Engineer, the Contractor will be responsible for the resulting losses, including, without limitation, the costs of correcting defective work.

3-7.2 Precedence of Contract Documents

The following paragraph is added to subsection 3-7.2 of the Greenbook:

As the figured dimensions shown on the plans and in the specifications of the Contract may not in every case agree with scaled dimensions, the figured dimensions will be followed in preference to the scaled dimensions, and plans to a large scale will be followed in preference to the plans to a small scale. Should it appear that the work to be done, or any of the matters relative thereto, are not sufficiently detailed or explained in the Contract, the Contractor will apply to the Engineer for such further explanations as may be necessary, and will conform thereto as part of the Contract so far as may be consistent with the terms thereof. Any items shown on drawings and not mentioned in the specifications will be of like effect as if shown or mentioned in both.

3-7.3 Accuracy of Plans and Specifications

Add the following subsection:

Although it is believed that much of the information pertaining to conditions and existing utilities that may affect the cost of the Work will be shown on the Plans or indicated in the Specifications, the City does not warrant the completeness or accuracy of such information. The Contractor is responsible for contacting 811 – Dig Alert prior to the commencement of the Contract Work and maintaining the status of the notice.

The Contractor will carefully study and compare each of the Contract Documents with the others and with information furnished by the City and will promptly report in writing to the Engineer any errors, inconsistencies, or omissions in the Contract Documents or inconsistencies with applicable law observed by the Contractor.

The Contractor will take field measurements, verify field conditions, perform soil investigations, and carefully compare with the Contract Documents such field measurements, conditions, and other information known to the Contractor before commencing the Work. Errors, inconsistencies, or omissions discovered at any time will be promptly reported in writing to the Engineer.

3-10 SURVEYING

Add the following Subsection 3-10.3, Survey Service:

3-10.3 Survey Service

3-10.3.1 Construction Surveying

The Contractor will provide for all construction surveys required to layout, monitor and complete the work. The surveys shall be performed by a Land Surveyor or Civil Engineer authorized to practice land surveying by the State of California.

Computations, survey notes, and other data used to accomplish the work will be neat, legible and accurate. Copies of all computations, survey notes, and other data (electronic format may be required) will be furnished to the Engineer before beginning work that requires their use.

The Project Benchmark is shown on the plans. The Contractor will establish all necessary control lines based on the plans and record information on file with the County of Los Angeles Surveyor and the Engineer.

It is the responsibility of the Contractor to protect the survey control as shown on the plans. If the survey control is destroyed or disturbed during construction, the Contractor shall be responsible for resetting them and to file appropriate documents with the County of Los Angeles, at the direction of the Engineer.

3-10.3.2 Measurement and Payment

Construction Survey – Unless a separate bid item is provided, payment shall be considered to be included in the other items of the bid and no additional payment will be made therefore.

3-12 WORK SITE MAINTENANCE

Delete Subsection 3-12.1, General and replace with the following:

3-12.1 Cleanup and Dust Control

3-12.1.1 General

On any construction Project requiring trenching within public streets and for which total trenching is in excess of 500 feet, the Contractor will be required to sweep the worksite utilizing a pick-up type street sweeper a minimum of once daily.

3-12.1.2 Watering

Water for dust control caused by Contractor's operations or the passage of traffic through the work will be applied as necessary or as directed by the Engineer. Water for the above or other purposes may be obtained from any approved source. If the Contractor chooses to use a City fire hydrant upon placing deposits and fees as described in this contract, the Engineer will cause a meter to be installed. All water used from the hydrant will be metered and charged to the Contractor at the prevailing rate plus the current daily meter rental rate. The Contractor will be charged a \$15 reconnect fee if the Contractor wishes to move the meter to a different hydrant.

Payment for the costs of water to be used shall be included in the cost of various associated bid items.

3-12.6 Water Pollution Control

The following requirements are added to establish storm water and urban runoff pollution prevention controls.

- (a) Storm or construction generated water containing sediment such as, construction waste, soil, slurry from concrete/asphalt concrete saw cutting operations, clean-up of concrete transit mixers or other pollutants from construction sites and parking areas will be retained or controlled on site and will not be permitted to enter the storm drain system.
- (b) Temporary sediment filtering systems such as sandbags, silt fences, or gravel berms will be utilized to trap sediment so that only filtered water enters the City's storm drain system. Proper clean up and disposal of settled sediment and the filtering system will be the responsibility of the Contractor.
- (c) Discharge of concrete transit mixer wash water on to approved dirt areas (sub-grade area designated for new concrete construction for example) is acceptable. Discharge on to private property, parkway areas, or the street is not permitted.
- (d) Plastic or other impervious covering will be installed where appropriate to prevent erosion of an otherwise unprotected area, along with any other runoff control devices deemed appropriate by the City.
- (e) Excavated soil stored on the site will be covered in a manner that minimizes the amount of sediments running into the storm drain system, street or adjoining properties.
- (f) No washing of construction or other industrial vehicles and equipment will be allowed adjacent to a construction site. During the rainy season (October 15 to April 15), Contractor will keep at the construction site sufficient materials and labor to install temporary sediment filtering systems and other water pollution prevention control measures. These control measures will be in place and maintained by the Contractor on a daily basis on days when construction is not in progress due to rain.
- (g) All costs associated with water pollution control will be borne by the Contractor. Any expense incurred by the City to expeditiously respond to storm drain contamination resulting from Contractor's failure to implement water pollution control measures will be charged to the Contractor.

3-12.7 Protection and Restoration of Existing Improvements

The following requirements are added to Section 3-12:

Where existing traffic striping, pavement markings, and curb markings are damaged or their reflectivity reduced by the Contractor's operations, such striping or markings will also be considered as existing improvements and the Contractor will replace such improvements.

Relocations, repairs, replacements, or re-establishments will be at least equal to the existing improvements and will match such improvements in finish and dimensions unless otherwise specified.

Payment shall be included in corresponding Bid Items.

3-12.7 Public Convenience and Safety

Insert the following Subsection to Section 3-12:

Unless otherwise specified all traffic control will be performed in accordance with the Work Area Traffic Control Handbook (WATCH) Latest Edition, published by BNi Building News, 990 Park Center Drive, Suite E, Vista, CA (760) 734-1113/www.bnibooks.com.

3-12.8.1 Traffic and Access

The Contractor will notify the occupants of all affected properties at least 48 hours before any temporary obstruction of access. Vehicular access to property line will be maintained except as required for construction for a reasonable period of time. No overnight closure of any driveway will be allowed except as permitted by the Engineer.

At least one (1) twelve (12) foot wide traffic lane will be provided for each direction of travel on all streets at all times except as permitted by the Engineer. The traffic lanes will be maintained on pavement, and will remain unobstructed. All work requiring that a lane be closed or a lane moved right or left will be noticed to the traveling public by use of City approved lighted arrow boards.

Clearances from traffic lanes will be five (5) feet to the edge of any excavation and two (2) feet to the face of any curb, pole, barricade, delineator, or other vertical obstruction.

One four (4) foot wide paved pedestrian walkway will be maintained in the parkway area on each side of all streets. The clearance from the pedestrian walkway to any traffic lane will be five (5) feet. Pedestrians and vehicles will be protected from all excavations, material storage, and/or obstructions by the placement of an adequate number of lighted barricades (minimum two (2)) at each location, one (1) at each end of the obstruction or excavation), which will have flashing lights during darkness. Barricades will be Type I or Type II per Section 7-3 of the WATCH Manual and lights will be Type A per Section 7-6 of the "Work Area Traffic Control Handbook"

(WATCH).

3-12.8.2 Street Closures, Detours, Barricades

Street closures will not be allowed except as specifically permitted by the Engineer.

The Contractor will prepare any traffic control or detour plans that may be required as directed by the Engineer. Lane transitions will not be sharper than a taper of thirty (30) to one (1).

Temporary traffic channelization will be accomplished with barricades or delineators. Temporary striping will not be allowed unless specifically permitted by the Engineer. The Contractor will prepare any plans that may be required for temporary striping to the satisfaction of the Engineer. In no event will temporary striping be allowed on finish pavement surfaces, which are to remain.

Where access to driveway or street crossings need to be maintained, minimum 1 1/4 inch thick steel plating will be used to bridge the trench. All steel plating will have temporary asphalt concrete 1:12 minimum sloped ramps to assist vehicles to cross comfortably over the plates and have a non-skid surface. Plates subject to vehicle high traffic speeds and in residential areas will be secured by welding at the discretion of the Engineer.

3-12.8.3 Protection of the Public

It is part of the service required of the Contractor to make whatever provisions are necessary to protect the public. The Contractor will use foresight and will take such steps and precautions as his operations warrant to protect the public from danger, loss of life or loss of property, which would result from interruption or contamination of public water supply, interruption of other public service, or from the failure of partly completed work or partially removed facilities. Unusual conditions may arise on the Project which will require that immediate and unusual provisions be made to protect the public from danger, loss of life, or damage to person and property, due directly or indirectly to prosecution of work under this contract.

Whenever, in the opinion of the Engineer, an emergency exists against which the Contractor has not taken sufficient precaution for the public safety, protection of utilities and protection of adjacent structures or property, which may be damaged by the Contractor's operations and when, in the opinion of the Engineer, immediate action will be considered necessary in order to protect the public or property due to the Contractor's operations under this contract, the Engineer will order the Contractor to provide a remedy for the unsafe condition. If the Contractor fails to act on the situation immediately, the Engineer may provide suitable protection to said interests by causing such work to be done and material to be furnished as, in the opinion of the Engineer, may seem reasonable and necessary.

The cost and expense of said labor and material, together with the cost and expense of such repairs as are deemed necessary, will be borne by the Contractor. All expenses incurred by the City for emergency repairs will be deducted from the progress payments and the final payment due to the Contractor. Such remedial measures by the City will not relieve the Contractor from full responsibility for public safety.

3-13 COMPLETION AND ACCEPTANCE

Delete Subsection 3-13 of the Greenbook is deleted in its entirety and replace with the following:

The Work will be inspected by the Engineer for acceptance upon the Engineer receiving the Contractor's written assertion that the Work is complete.

If, in the Engineer's judgment, the Work is complete and is ready for acceptance, the Engineer will accept the Work on behalf of the City in the manner prescribed by the City. The Engineer will recommend approval of the Notice of Completion to the City Council. This will be the date when the Contractor is relieved from responsibility to protect the Work.

All work will be guaranteed by the Contractor against defective workmanship and materials furnished by the Contractor for a period of 1 year from the date the Work was completed. The Contractor will replace or repair any such defective work in a manner satisfactory to the Engineer, after notice to do so from the Engineer, and within the time specified in the notice. If the Contractor fails to make such replacement or repairs within the time specified in the notice, the City may perform this work and the Contractor's sureties will be liable for the cost thereof.

3-13.1 General Guaranty

The Contractor will remedy any defects in the work and pay for any damage to other nearby improvements resulting therefrom, which will appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The owner will give notice of observed defects with reasonable promptness.

SECTION 4 – CONTROL OF MATERIALS

4-3 INSPECTION

Delete Subsection 4-3 and replace with the following:

4-3.1 General

Unless otherwise specified, inspection at the source of production for such materials and fabricated items as bituminous paving mixtures, structural concrete, fabricated metal products, cast metal products, welding, reinforced and unreinforced concrete

pipe, application of protective coatings, and similar shop and plant operations is not required. A certificate of compliance, signed by an authorized officer of the producer, certifying compliance with the contract documents will be submitted for all of the following materials: steel pipe, sizes less than 18 inches; vitrified clay pipe; asbestos cement pipe; cast iron pipe; reinforced concrete pipe; non-reinforced concrete pipe; and PVC sewer and water pipe; subject to sampling and testing by City.

Standard items of equipment, such as electric motors, conveyors, plumbing fittings and fixtures, lumber, plywood, and so on, are subject to inspection at the job site.

All other equipment items will be inspected and tested in accordance with the contract documents.

The City does not provide full time inspection. The Contractor will provide 24-hour minimum notice for each inspection required by the work unless other arrangements have been agreed upon, in writing, with the City Engineer. Any inspection required outside of normal working hours and days, including holidays, will be at the Contractor's cost at rates established by the City.

4-6 TRADE NAMES

Delete Subsection 4-6 and replace with the following:

4-6.1 Trade Names or Equals

Whenever any material, product, equipment, or service is specified by brand, trade, or proprietary name, the item so specified will be deemed to be followed by the words "or equal".

For the City's consideration of a proposed "equal" item, the Bidder must submit, a minimum of ten (10) calendar days before the date of the bid opening, documentation of the particulars of the proposed "equal item". At a minimum, the submitted documentation will include:

- Written request with explanation of why the product should be considered as an equal product.
- Material specifications.
- Technical specifications.
- Test data.
- Samples.
- Comparison chart of key specifications of the "equal" item against similar specifications of the specified item.
- Work locations and reference telephone numbers of at least three (3) locations where the proposed "equal" item has been recently installed under similar conditions.
- Warranty data.

The Bidder will be notified by the Engineer whether or not the proposed "equal" product is acceptable to the City five (5) calendar days before the date of the bid opening. Failure to submit all required documentation and/or submittal of incomplete documents may result in the City's rejection of the proposed "equal" product without further consideration.

SECTION 5 – LEGAL RELATIONS AND RESPONSIBILITIES

5-3 LABOR

Add the following subsections:

5-3.2 Prevailing Wages

The Contractor will post at appropriate conspicuous points at the site of the Project the prevailing wage determinations for the Project based on the Bid Dates from the Director of the Department of Industrial Relations (DIR) of the prevailing rate of per diem wages.

The Contractor shall obtain copies of the prevailing rate of per diem wages the California Department of Industrial Relations website which is currently located at www.dir.ca.gov, or by calling the Prevailing Wage Unit at (415) 703-4774.

5-3.5 Apprentices

Add the following to the Subsection:

Attention is directed to Labor Code §§ 1777.5, 1777.6 and 3098 concerning the employment of apprentices by the Contractor or any subcontractor.

Labor Code § 1777.5 requires the Contractor or subcontractor employing tradesmen in any apprenticeship occupation to apply to the joint apprenticeship committee nearest the site of the Public Works Project and which administers the apprenticeship program in that trade for a certificate of approval. The certificate will also fix the ratio of apprentices to journeymen that will be used in the performance of the contract. The ratio of apprentices to journeymen in such cases will not be less than one to five except:

- a) When employment in the area of coverage by the joint apprenticeship committee has exceeded an average of 15 percent in the ninety (90) calendar days before the request for certificate, or
- b) When the number of apprentices in training in the area exceeds a ratio of one to five, or
- c) When the trade can show that it is replacing at least 1/30 of its membership through apprenticeship training on an annual basis state-wide or locally, or
- d) When the Contractor provides evidence that the Contractor employs registered apprentices on all of his contracts on an annual average of not less than one apprentice to eight journeymen.

The Contractor is required to make contributions to funds established for the administration of apprenticeship programs if the Contractor employs registered apprentices or journeymen in any apprenticeable trade on such contracts and if other contractors on the Public Works site are making such contributions.

The Contractor and any subcontractor will comply with Labor Code §§ 1777.5 and 1777.6 in the employment of apprentices.

Information relative to apprenticeship standards, wage schedules and other requirements may be obtained from the Director of Industrial Relations, ex-officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

5-3.3 Record of Wages Paid: Audit

Every Contractor and subcontractor will keep an accurate certified payroll records showing the name, occupation, and the actual per diem wages paid to each worker employed in connection with the Work. The record will be kept open during normal construction hours for audit or inspection by the City Department or Representative that awarded the contract and to the Division of Labor Law Enforcement. If requested by the City, the Contractor will provide copies of the records at its cost.

5-4 INSURANCE

Delete Subsection and insert the following:

5-4.1 General

Liability policies will contain, or be endorsed to contain the provisions specified in these Supplemental Provisions and the Standard Specifications.

Contractor must procure and maintain for the duration of the contract the following insurance coverages and limits against claims for injuries to persons or damage to property that may arise from or in connection with the performance of the work covered by this agreement by the Contractor, its agents, representatives, employees or subcontractors:

COVERAGE PER OCCURRENCE	ISO FORM	COMBINED SINGLE LIMIT
Comprehensive General Liability	CL 00 01 04 13	\$2,000,000
Business Auto	CA 00 01 06 92	\$1,000,000
Workers' Compensation		Statutory

Contractor will provide endorsements or other proof of coverage for contractual liability.

Each insurance policy required by this subsection will be endorsed to state that

coverage will not be suspended, voided, cancelled by either party, reduced in coverage or in limits except after thirty (30) calendar days written notice by certified mail, return receipt requested, has been given to:

CITY CLERK
City of El Segundo
350 Main Street
El Segundo, CA 90245

Notwithstanding the foregoing, the endorsement may state that insurance may be cancelled upon thirty (30) calendar day notification for non-payment of premium. The Contractor will provide the City with updated proof of insurance should the Contract Time extend beyond the policy expiration date.

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

Except for Workers Compensation Insurance, Contractor will furnish to City certificates of insurance and endorsements on forms acceptable to the City's City Attorney, duly authenticated, giving evidence of the insurance coverages required in this contract and other evidence of coverage or copies of policies as may be reasonably required by City from time to time. Endorsements must be supplied on ISO Form No. CG 20 10 11 85, or equivalent. Certificate/endorsement for Workers Compensation Insurance will be furnished on State Comp Fund or other industry standard form. Except for worker's compensation insurance, all insurance required herein will be placed with insurers with a Best's Rating of not less than A:VII. Worker's compensation insurance policies will meet the requirements of California law.

All subcontractors employed on the work referred to in this contract will meet the insurance requirements set forth for Contractor. Contractor will furnish certificates of insurance and endorsements for each subcontractor at least five days before the subcontractor entering the job site, or Contractor will furnish City an endorsement including all subcontractors as insureds under its policies.

Except as provided in Subsection 6-5, the Contractor will save, keep and hold harmless the City, its officers, officials, employees, agents and volunteers from all damages, costs or expenses in law or equity that may 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. The City will not be liable for any accident, loss or damage to the work before its completion and acceptance, except as provided in Subsection 6-5.

The cost of such insurance will be included in the various items of work in the Contractor's bid and no additional compensation for purchasing insurance or additional coverage needed to meet these requirements will be allowed.

In the event that any required insurance is reduced in coverage, cancelled for any reason, voided or suspended, Contractor agrees that City 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. Contractor **will not** be allowed to work until alternate coverage is arranged.

Coverage will not extend to any indemnity coverage for the active negligence of the additional insured if the agreement to indemnify the additional insured would be invalid under Civil Code § 2782(b).

Combined single limit per occurrence will include coverage for bodily injury, personal injury, and property damage for each accident.

If Commercial General Liability Insurance or other form with a general aggregate limit is used, the policy will be endorsed such that the general aggregate limit will apply separately to this contract and a copy of the endorsement provided to the City.

5-4.2 General Liability

The Contractor's insurance coverage will be primary insurance as respects to the City, its officers, officials, employees, agents, and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, employees, agents, and volunteers will be in excess of the Contractor's insurance and will not contribute with to the Contractor's Combined Single Limit.

The City, its officers, officials, employees, agents, and volunteers will be covered as insureds as to any respect of any liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor. The coverage will contain no special limitations on the scope or protection afforded to the City, its officers, officials, employees, agents, or volunteers.

The insurer will agree in writing to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the City.

Any failure to comply with reporting provisions of the policies will not affect coverage provided to the City, its officers, officials, employees, agents and volunteers.

The Contractor's insurance will 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.

5-4.3 Worker's Compensation

The insurer will agree to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the City.

5-4.4 Auto Liability Insurance

The City, its officers, officials, employees, agents, and volunteers will be covered as insureds as to any respect of any liability arising out of activities performed by or on behalf of the Contractor in automobiles owned, leased, hired or borrowed. The coverage will contain no special limitations on the scope or protection afforded to the City, its officers, officials, employees, agents, or volunteers.

The insurer will agree in writing to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the City.

Any failure to comply with reporting provisions of the policies will not affect coverage provided to the City, its officers, officials, employees, agents and volunteers.

The Contractor's insurance will 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.

The insurer will agree to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the City.

5-4.5 Indemnification and Defense

In addition to the provisions of Subsection 5-4 of the Greenbook as between the City and Contractor. The Contractor will take and assume all responsibility for the Work as stated herein or shown on the plans.

The Contractor will bear all losses and damages directly or indirectly resulting to the Work. The Contractor shall hold harmless the City, its officers, employees, and agents, or to others on account of the performance or character of the work, unforeseen difficulties, accidents, traffic control, job site maintenance, or any other causes whatsoever.

The Contractor will assume the defense of and indemnify and save harmless the City

of El Segundo, 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, howsoever 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 § 2782, nothing in this Subsection 5-4.2 or in Subsection 5-4 of the Standard Specifications will 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 City, or its agents, servants or independent contractors who are directly responsible to the City, or for defects in design furnished by such persons. Moreover, nothing in this Subsection 5-4.2 or in Subsection 5-4 will apply to impose on the Contractor, or to relieve the City from, liability for active negligence of the City.

The City does not, and will not, waive any rights against the Contractor which it may have by reason of the aforesaid hold harmless agreements because of the acceptance by the City, or deposit with City by Contractor, of any insurance policies described in Subsection 5-4 of the Special Provisions. This hold harmless agreement by the Contractor will apply to all damages and claims for damages of every kind suffered, or alleged to have been suffered by reasons of any of the aforesaid operations of Contractor, or any subcontractor, regardless of whether or not such insurance policies are determined to be applicable to any of such damages or claims for damages.

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

5.7 SAFETY

5-7.4 Hazardous Material

Insert the following Subsection:

For any excavation, which extends more than four feet below existing grade, the Contractor will promptly, and before the conditions are disturbed, notify the Engineer, in writing, of:

- 1) any material that the Contractor believes may be hazardous waste, as defined in Health and Safety Code § 25117, which is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
- 2) subsurface or latent physical conditions at the site differing from those indicated.
- 3) unknown physical conditions at the site of any unusual nature,

different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

After receiving notice from the Contractor, the Engineer will promptly investigate any condition identified by the Contractor as being hazardous. The rights and obligations of the City and the Contractor with regard to such conditions (including, without limitation, the procedures for procuring change orders and filing claims) will be specified by the provisions of Subsection 2-9 (Changed Conditions) of the Greenbook.

If a dispute arises between the City and the Contractor whether the conditions materially differ, involve hazardous waste, or cause a change in the Contractor's cost or time required for performance of the work, the Contractor will not be excused from any scheduled completion date provided for by the contract, but will proceed with all work to be performed under the contract. The Contractor will retain all rights provided by Subsection 2-10, Disputed Work, of the Greenbook.

If the Engineer determines that material called to the Engineer's attention by the Contractor is hazardous waste, or if the Engineer otherwise discovers the existence of hazardous waste, the Contractor will be responsible for removal and disposal of the hazardous waste by qualified personnel and appropriate equipment in the manner required by law as directed by the Engineer, subject to the provisions of Section 2 (Scope of Work) of the Greenbook.

SECTION 6 - PROSECUTION AND PROGRESS OF THE WORK

6-1 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF WORK

Delete Section 6-1, and replace with the following:.

Pre-Construction Meeting:

After contract award, the City will arrange for a pre-construction meeting to discuss the construction of the Project. The City will invite utility agencies and the contractor will arrange for all of its subcontractors to attend the meeting.

6-1.1 Contract Schedule

After notification of award and before starting any work, the Contractor will submit a Contract Schedule to the Engineer for review, as required by these Specifications within fifteen (15) calendar days of award.

6-1.2 Content of the Contract Schedule

The Contract Schedule, and any Contract Schedule updates, shall meet the following

requirements:

1. Schedules must be suitable for monitoring progress of the Work.
2. Schedules must provide necessary data about the time for the Engineer's decisions.
3. Schedules must be sufficiently detailed to demonstrate adequate planning for the Work.
4. Schedules must represent a practical plan to complete the Work within the Contract Time.
5. Schedules must show the critical path method for completing the Work.

The Engineer's review of the form and general content of the Contract Schedule and any Contract Schedule updates are only for the purpose of determining if the listed requirements are satisfied, nothing more.

6-1.3 Effect of Contract Schedule

The Contract Schedule, and any Contract Schedule updates, will represent a practical plan to complete the Work within the Contract Time. Extension of any schedule beyond the Contract Time will not be acceptable. Schedules showing the Work completed in less than the Contract may be acceptable if judged by the Engineer to be practical. Acceptance of such a schedule by the Engineer will not change the Contract Time. The Contract Time, not the Contract Schedule, will control in determining liquidated damages payable by the Contractor and in determining any delay.

If a schedule showing the Work completed in less than the Contract Time is accepted, the Contractor will not be entitled to extensions of the Contract Time for Excusable Delays or Compensable Delays or to adjustments of the Contract Sum for Compensable Delays until such delays extend the completion of the Work beyond the expiration of the Contract Time.

The Contractor will plan, develop, supervise, control, and coordinate the performance of the Work so that its progress and the sequence and timing of Work activities conform to the current accepted Contract Schedule. The Contractor will continuously obtain from Subcontractors information and data about the planning for and progress of the Work and the delivery of equipment, will coordinate and integrate such information and data into Contract Schedule updates and will monitor the progress of the Work and the delivery of equipment. The Contractor will act as the expeditor of potential and actual delays, interruptions, hindrances, or disruptions for its own forces and those forces of Subcontractors. The Contractor will cooperate with the Engineer in developing the Contract Schedule and updated Contract Schedules.

The Engineer's review and comments about any schedule or scheduling data will not relieve the Contractor from its sole responsibility to plan for, perform, and complete the Work within the Contract Time. Review and comments about any schedule will not transfer responsibility for any schedule to the Engineer or the City nor imply their

agreement with (1) any assumption upon which such schedule is based or (2) any matter underlying or contained in such schedule.

The Engineer's failure to discover errors or omissions in schedules that have been reviewed, or to inform the Contractor that the Contractor, Subcontractors, or others are behind schedule, or to direct or enforce procedures for complying with the Contract Schedule will not relieve the Contractor from its sole responsibility to perform and complete the Work within the Contract Time and will not be a cause for an adjustment of the Contract Time or the Contract Sum.

The Contractor will perform the Work in accordance with the currently accepted Contract Schedule.

6-1.4 Commencement of Contract Time

The Contract Time will commence when the City issues a Notice to Proceed. The Work will start on the date specified in the Notice to Proceed and within a maximum of fifteen (15) calendar days after the date of the Notice to Proceed, and be diligently prosecuted to completion with the time provided in the Specifications.

6-3.3 Working Days and Working Hours

City Hall is open from Monday thru Thursday 7am -5pm and Friday's 7am-4pm. It is closed the following holidays:

New Year's Day
Martin Luther King, Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Veteran's Day
Thanksgiving
Christmas Eve
Christmas
New Year's Eve
New Year's Day

Working on Fridays when City Hall is closed is acceptable. If the Contractor, however, requests an inspection a day when City Hall is closed, then the Contractor will have to reimburse the City for the costs of inspection. The Contractor must request such an inspection at least 48 hours in advance. City inspections during hours when City Hall is closed are subject to inspection overtime fees to be paid for by the Contractor. Friday work that does not require inspection can be done without an

inspection fee and must be discussed with City staff before its occurrence. If the Contractor does construction on a Friday or a day when City Hall is closed, that day is counted as a project working day.

On workdays, Contractor's activities will be confined to the hours between 7:00 a.m. and 4:00 p.m. Please see Section 6-7.5 below for weekend and holiday work restrictions.

6-3.4 Night Work

Add the following paragraph:

The City will not permit Work between the hours of 4 p.m. and 7 a.m. of the following day unless specifically provided for in the bid documents or unless the Contractor receives prior written approval.

6-3.5 Weekend and Holiday Work

The Engineer may, but is not required to, allow the Contractor to work on Saturdays, Sundays and City Holidays.

6-4 DELAYS AND EXTENSIONS OF TIME

Delete and replace with the following:

6-4.1 General

If delays are caused by unforeseen events beyond the control of the Contractor, such delays will entitle the Contractor to an extension of time as provided herein, but the Contractor will not be entitled to damages or additional payment due to such delays except as otherwise provided herein. Excusable delay may include: war, earthquakes exceeding 3.5 on the Richter Scale, government regulation, labor disputes outside the contemplation of the parties, strikes outside the contemplation of the parties, fires, floods, changes to the Work as identified herein, or other specific events that may be further described in the Specifications.

Delays to the Project caused by labor disputes or strikes involving trades not directly related to the Project, or involving trades not affecting the Project as a whole will not warrant an extension of time.

The City will not grant an extension of time for a delay by the Contractor's inability to obtain materials unless the Contractor furnishes to the Engineer documentary proof. The proof must be provided in a timely manner in accordance with the sequence of the Contractor's operations and accepted construction schedule.

Should delays be caused by events other than those included herein, the Engineer

may, but is not required to, deem an extension of time to be in the City's best interests.

6-4.2 Extensions of Time

If granted, extensions of time will be based upon the effect of delays to the critical path of the Work as determined by the current accepted Contract Schedule. Delays to minor portions of the Work that do not affect the critical path will not be eligible for extensions of time.

6-4.3 Payment for Delays to Contractor

Any payment for compensable delay will be based upon actual costs as set forth in Subsection 402-5.1 excluding, without limitation, what damages, if any, the Contractor may have reasonably avoided. The Contractor understands that this is the sole basis for recovering delay damages and explicitly waives any right to calculate daily damages for office overhead, profit, or other purported loss, using different formulas including, without limitation, the Eichleay Formula.

6-4.4 Written Notice and Report

If the Contractor desires payment for a delay or an extension of time, it will give the Engineer written notice of such request not later than the time limit set forth in the Proposal for submitting a claim after the event or occurrence giving rise to a delay claim. Failure to submit a written request within such amount of time will result in the Contractor waiving its delay claim.

Any claim for payment or an extension of time must be in the form required by the "Claims" sections of these Specifications.

In no event will the City grant the Contractor an extension of time if the delay is within the Contract Time as identified by the Contract Documents.

6-7 DEFAULT BY CONTRACTOR

The language in subsection 6-7 is deleted in its entirety and replaced with the following subsections.

6-7.1 General

Should the Contractor fail to begin delivery of material and equipment, to commence the Work within the time specified, to maintain the rate of delivery of material, to execute the Work in the manner and at such locations as specified, or fail to maintain the Work schedule (as determined by the current accepted Contract Schedule) which will ensure the City's interest, or if the Contractor is not carrying out the intent of the Contract, the City may serve written notice upon the Contractor and the Surety on its

Faithful Performance Bond demanding satisfactory compliance with the Contract.

6-7.2 Termination of Contractor's Control Over the Work

The City may terminate the Contractor's control over the Work without liability for damages when, in the City's opinion, the Contractor is not complying in good faith, has become insolvent, or has assigned or subcontracted any part of the Work without the City's consent. Should such termination occur, the Contractor will be paid the actual amount due based on Contract Unit Prices or lump sums bid and the quantity and quality of the Work completed at the time of termination, less damages caused to the City by the Contractor's action or inaction.

In the event of such termination of control, the City may do any one, or combination of, the following:

1. Serve written notice upon the Surety on its Faithful Performance Bond demanding satisfactory compliance with the Contract. In such event the Surety will, within 5 days, assume control and perform the Work as successor to the Contractor;
2. The City may perform the Work itself and deduct the cost thereof from any payment due to the Contractor;
3. The City may replace the Contractor with a different contractor to complete the work and deduct the cost thereof from any payment due to the Contractor.

Nothing herein will waive, or serve as a limitation upon, any additional remedy the City may have under these Contract Documents or applicable law.

6-7.3 Surety's Assumption of Control

Should the Surety assume any part of the Work, it will take the Contractor's place in all respects for that part, and will be paid by the City for all work performed by it in accordance with the Contract. If the Surety assumes the entire Contract, all money due the Contractor at the time of its default will be payable to the Surety as the Work progresses, subject to the terms of the Contract.

If the Surety does not assume control and perform the Work within 5 days after receiving notice of cancellation, or fails to continue to comply, the City may exclude the Surety from the premises. The City may then take possession of all material and equipment and complete the Work by City's forces, by letting the unfinished work to another contractor, or by a combination of such methods. In any event, the cost of completing the Work will be charged against the Contractor and its Surety and may be deducted from any money due or becoming due from the City. If the sums due under the Contract are insufficient for completion, the Contractor or Surety will pay to the City within 5 days of completion, all costs in excess of the sums due.

The provisions of this subsection will be in addition to all other rights and remedies

available to the City under applicable law.

6-9 LIQUIDATED DAMAGES

Delete and replace with the following:

6-9.1 Failure to Complete Work on Time

If all the work called for under the contract is not completed before or upon the expiration of the Contract Time, the City will sustain damage. Since it is and will be impracticable to determine the actual damage which the City will sustain in the event of and by reason of such delay, it is therefore agreed that the Contractor will pay to the City the sum specified in the Proposal for each and every calendar day beyond the time prescribed to complete the work not as a penalty, but as a predetermined liquidated damage. The Contractor agrees to pay such liquidated damages as are herein provided, and in case the same are not paid, agrees that the City may deduct the amount thereof from any money due or that may become due to the Contractor under the contract.

Unless otherwise specified, liquidated damages will be \$250 per calendar day.

SECTION 7 – MEASUREMENT AND PAYMENT

7-2 LUMP SUM WORK

Subsection 7-2, Lump Sum Work, of the Greenbook is deleted in its entirety and replaced by the following:

Items for which quantities are indicated as "Lump Sum," "L.S.," or "Job" will be paid for at the price indicated in the Proposal. Such payment will be full compensation for all costs for labor, equipment, materials and plant necessary to furnish, construct and install the lump sum item of work, complete, in place, and for all necessary appurtenant work, including, but not limited to, all necessary cutting, patching, repair and modification of existing facilities, and clean up of site.

Contractor will furnish three copies of a detailed schedule, which breaks down the lump sum work into its component parts and cost for each part, in a form and sufficiently detailed as to satisfy Engineer that it correctly represents a reasonable apportionment of the lump sum. This schedule is subject to approval by Engineer as to both the components into which the lump sum item is broken down, and the proportion of cost attributable to each component.

This schedule will be the basis for progress payments for the lump sum work.

7.3 PAYMENT

7-3.2 Partial and Final Payments

Delete and replace with the following:

The closure date for the purpose of making partial progress payments will be the *last working day of each month*. The Contractor will prepare the partial payment invoice with measurement of the work performed through the closure date and submit it to the CITY for approval.

When work is complete, the Contractor will determine the final quantities of the work performed and prepare the final progress payment, and submit it to the Engineer for approval.

It will take a minimum of thirty-five (35) calendar days from the date of approving the Contractor's invoice to make the payment to the Contractor. However, payments will be withheld pending receipt of any outstanding reports required by the contract documents, or legal release of filed Stop Payment Notices against the Contractor. In addition, the final progress payment will not be released until the Contractor returns the control set of Plans and Specifications showing the as-built conditions.

The full five percent (5%) retention will be deducted from all progress payments. The Contractor will make a payment request for the retained amount, for approval by the City, upon field acceptance of the work by the City Engineer. The City Engineer upon field acceptance and receipt of the final as-built plans and any other reports or documents required to be provided by the Contractor will process a recommendation to the City Council for acceptance of the work. Not less than thirty-five (35) calendar days from the City Council acceptance of the work, the Contractor's final payment will be made provided Stop Payment Notices or other claims have not been filed against the Contractor and/or the City by material suppliers, subcontractor, other governmental agencies, and private property owners. Until these Stop Payment Notices are released and claims are resolved the stop payment/claim amount will be withheld from the final payment.

The Contractor, however, may receive interest on the retention for the length of construction, or receive the retention itself as long as the retention is substituted with escrow holder surety or equal value.

At the request and expense of the Contractor, surety equivalent to the retention may be deposited with the State Treasurer, or a State or Federally chartered bank, as the escrow agent, who will pay such surety to the Contractor upon satisfactory completion of the contract.

Pursuant to PCC § 22300, the Contractor may substitute securities for retention monies held by the City or request that the City place such monies into an escrow account. The Contractor is notified, pursuant to PCC § 22300, that any such election will be at the Contractor's own expense and will include costs incurred by the City to

accommodate the Contractor's request.

Progress payment paid by the City as contemplated herein, will be contingent upon the Contractor submitting, in addition to any additional documents, an updated Contract Schedule in the form prescribed by these Contract Documents. Failure of the Contractor to submit an acceptable updated Contract Schedule will result in the City withholding partial payment, without liability to the City, until such an acceptable updated Contract Schedule is submitted. Nothing herein will allow the Contractor to suspend or slow progress of the Work.

A City Council resolution established a Project Payment Account, encumbered money in the current budget, and assigned that money to the Project Payment Account which is the sole source of funds available for payment of the Contract Sum. Contractor understands and agrees that Contractor will be paid only from this special fund and if for any reason this fund is not sufficient to pay Contractor, Contractor will not be entitled to payment. The availability of money in this fund, and City's ability to draw from this fund, are conditions precedent to City's obligation to make payments to Contractor.

7-3.2.1 Final Payment and Termination of Agency Liability

Before receiving final payment, the Contractor will execute a "Release on Contract" form which will operate as, and will be a release to the City, the City Council, and each member of the City Council and their agencies, from all claims and liability to the Contractor for anything done or furnished for, or relating to, the work or for any act of neglect of the City of any person relating to or affecting the work, except the claim against the City for the remainder, if any there be, of the amounts kept or retained as provided in Subsections 9-3 of the Standard Specifications and except for any unsettled claims listed on said form which have been filed in compliance with the requirements for making claims.

7-3.3 Delivered Materials

Materials and equipment delivered or stored, but not incorporated into the work, will not be approved for progress payments.

7.4 PAYMENT FOR EXTRA WORK

7-4.2 Basis for Establishing Costs

7-4.2.3 Tools and Equipment Rental

Delete the second and third paragraphs and replace with "Regardless of ownership, the rates to be used in determining the equipment usage costs will not exceed those listed for the same or similar equipment in the California State Department of Transportation publication of Labor Surcharge and Equipment Rates effective for the

period of usage.”

7-4.3 Markup

Delete and replace with the following:

7-4.3.1 Work by Contractor

The following percentages will be added to the Contractor’s costs and will constitute the markup for all overhead and profits.

1)	Labor	20
2)	Materials.....	15
3)	Equipment Rental	15
4)	Other Items and Expenditures	15

To the sum of the costs and markups provided for in this subsection, 1 percent will be added as compensation for bonding. No other formula, e.g., the Eichleay or other method, may be used to calculate daily damages for office overhead, profit, or other purported loss.

7-4.3.2 Work by Subcontractors

When all or any part of the extra work is performed by a Subcontractor, the markup established in 7-4.3(a) will be applied to the Subcontractor’s actual cost of such work. A markup of 10 percent on the first \$5,000 of the subcontracted portion of the extra work and a markup of 5 percent on work added in excess of \$5,000 of the subcontracted portion of the extra work may be added by the Contractor.

7-4.3.3 Compensable Delays

In the event that City becomes liable to Contractor for compensable delays, City agrees to pay Contractor the daily Contractor Delay Damages set forth in the Bid Form or Contractor’s actual daily delay damages, whichever is less, for each day of Compensable Delay as provided for by these Contract Documents.

7-4.4 Daily Reports by Contractor

Insert the following paragraph at the end of the subsection :

If disagreement continues regarding extra work, the Contractor may seek compensation in accordance with the Claims procedure. Daily Reports required by this subsection must be made part of the Claim as supporting data for the Claim.

7-4.5 Disputes and Claims Procedure

7-4.5.1 General

Consistent with PCC § 10240.6, “Claim” means a written demand or assertion by the Contractor that seeks an adjustment or interpretation of the terms of the Contract Documents, payment of money, extension of time, or other relief with respect to the Contract Documents, including a determination of disputes or matters in question between the City and the Contractor arising out of or related to the Contract Documents or the performance of the Work, and claims alleging an unforeseen condition or an act, error, or omission by the City, the Engineer, their agents or employees. “Claim” does not mean, and the Claims procedures herein do not apply, to the following:

1. Claims respecting penalties for forfeitures prescribed by statute or regulations, which a government agency is specifically authorized to administer, settle, or determine.
2. Claims respecting personal injury, death, reimbursement, or other compensation arising out of or resulting from liability for personal injury or death.
3. Claims respecting a latent defect, breach of warranty, or guarantee to repair.
4. Claims respecting stop notices.

If a Claim is subject to the Change Order procedures, the Claim arises upon the issuance of a written final decision denying in whole or in part the Contractor’s Change Order Request. If a Claim is not subject to the Change Order Procedures, the Claim arises when the Contractor discovers, or reasonably should discover, the condition or event giving rise to the Claim.

7-4.5.2 Form and Content

A Claim must include the following:

1. A statement that it is a Claim and a request for a decision.
2. A detailed description of the act, error, omission, unforeseen condition, event or other condition giving rise to the Claim.
3. If the Claim is subject to the Change Order procedures, a statement demonstrating that a Change Order Request was timely submitted and denied.
4. A detailed justification for any remedy or relief sought by the Claim, including to the extent applicable, the following:
 - a) If the Claim involves extra work, a detailed cost breakdown claimed. The breakdown must be provided even if the costs claimed have not been incurred when the Claim is submitted.

- b) To the extent costs have been incurred when the Claim is submitted, the Claim must include actual cost records (including, without limitation, payroll records, material and rental invoices) demonstrating that costs claimed have actually been incurred.
 - c) To the extent costs have not yet been incurred at the time the Claim is submitted, actual cost records must be submitted on a current basis not less than once a week during any periods costs are incurred. A cost record will be considered current if submitted within seven (7) calendar days of the date the cost reflected in the record is incurred. At the Engineer's request, claimed extra costs may be subject to further verification procedures (such as having an inspector verify the performance of alleged extra work on a daily basis).
5. If the Claim involves an error or omission in the Contract Documents:
- a) An affirmative representation that the error or omission was not discovered before submitting a bid for the Contract; and
 - b) A detailed statement demonstrating that the error or omission reasonably should not have been discovered by the Contractor, its Subcontractors and suppliers, before submitting a bid for the Contract.
6. If the Claim involves an extension of the Contract Time, written documentation demonstrating the Contractor's entitlement to a time extension.
7. If the Claim involves an adjustment of the Contract Sum for delay, written documentation demonstrating the Contractor's entitlement to such an adjustment.
8. A personal certification from the Contractor that reads as follows:
- "I, _____, BEING THE _____ (MUST BE AN OFFICER) OF _____ (CONTRACTOR NAME), DECLARE UNDER PENALTY OF PERJURY UNDER CALIFORNIA LAW, AND DO PERSONALLY CERTIFY AND ATTEST THAT I HAVE THOROUGHLY REVIEWED THE ATTACHED CLAIM FOR ADDITIONAL COMPENSATION OR EXTENSION OF TIME, AND KNOW ITS CONTENTS, AND SAID CLAIM IS MADE IN GOOD FAITH; THE SUPPORTING DATA IS TRUTHFUL AND ACCURATE; THAT THE AMOUNT REQUESTED ACCURATELY REFLECTS THE CONTRACT ADJUSTMENT FOR WHICH THE CONTRACTOR BELIEVES CITY IS LIABLE; AND, FURTHER, THAT I AM FAMILIAR WITH CALIFORNIA PENAL CODE § 72 AND CALIFORNIA GOVERNMENT CODE § 12650, ET SEQ., PERTAINING TO FALSE CLAIMS, AND FURTHER KNOW AND UNDERSTAND THAT SUBMITTING OR CERTIFYING A FALSE

CLAIM MAY LEAD TO FINES, IMPRISONMENT, AND OTHER
SEVERE LEGAL CONSEQUENCES.”

7-4.5.3 Claims Submitted to the Engineer

Within thirty (30) calendar days after the circumstances giving rise to a Claim occur, the Contractor will submit its Claim to the Engineer for a decision. Regardless of any Claim submittal, or any dispute regarding a Claim, unless otherwise directed by the Engineer, the Contractor will not cause any delay, cessation, or termination of the Work, but will diligently proceed with the performing the Work in accordance with the Contract Documents. Except as otherwise provided, the City will continue to make payments in accordance with the Contract Documents.

7-4.5.4 Claim is Prerequisite to Other Remedy

The Contractor certifies that it is familiar with PCC § 10240.2 and understands and agrees that submitting a Claim in accordance with these Specifications is an express condition precedent to the Contractor’s right to otherwise pursue a claim whether through alternative dispute resolution or by litigation. Should the Contractor fail to submit a claim in accordance with these Specifications, including the time limits set forth herein, it will waive any right to a remedy, whether in law or equity, it might otherwise have pursuant to the Contract Documents or applicable law.

7-4.5.5 Decision on Claims

The Engineer will promptly review Claims submitted by the Contractor in accordance with these Specifications. Should the Engineer require additional supporting evidence to evaluate the claim, the Engineer will request such additional information in writing. Any such requested data will be furnished not later than ten (10) calendar days after the Contractor receives the Engineer’s request.

The Engineer will render a decision not later than thirty (30) days after either receiving the Claim or the deadline for furnishing additional supporting data, whichever is later. If the Claim amount is more than \$50,000, the time period will be extended to sixty (60) days. If the Engineer fails to render a decision within the time period established herein, then the Claim will be deemed denied. The Engineer’s decision will be final and binding unless appealed in accordance with these Specifications.

The Engineer’s decision on a Claim will include a statement substantially as follows:

“This is a decision pursuant to the General Specifications of your contract. If you are dissatisfied with the decision, and have complied with the procedural requirements for asserting claims, you may have the right to alternative dispute resolution or litigation. Should you fail to take appropriate action within thirty (30) calendar days of the date of this decision, the decision will become final and binding and not subject

to further appeal.”

7-4.5.6 Appeal of Engineer’s Decision

Should the Contractor dispute the Engineer’s decision, then the Contractor must appeal that decision to the City’s Public Works Director within thirty (30) calendar days of receiving the Engineer’s decision.

The Public Works Director will address disputes or claims within thirty (30) calendar days after receiving such request and all necessary supporting data. The Public Works Director’s decision on the dispute or claim will be the City’s final decision.

If the Contractor disputes the Public Works Director’s decision, then the Contractor must demand alternative dispute resolution in accordance with this Section and the PCC within thirty (30) calendar days of the City’s final decision.

7-4.5.7 Mediation

If the City and the Contractor agree, disputes between the parties may be submitted to non-binding mediation. If the parties cannot agree to an alternative form of mediation, then mediation will be administered by the American Arbitration Association (“AAA”) under its Construction Industry Mediation Rules, unless the use of such rules are waived by mutual stipulation of both parties.

The parties may, but are not required to be, represented by counsel in mediation.

The requirement for mediation will not alter or modify the time limitations otherwise provided for claims and no conduct or settlement negotiation during mediation will be considered a waiver of the City’s right to assert that claim procedures were not followed.

7-4.5.8 Arbitration

If the City and Contractor do not agree to mediation, then a disputes will be submitted to neutral non-binding (except as provided herein) arbitration. Arbitration will be conducted in accordance with PCC § 10240.3. Any decision rendered by an arbitrator will be consistent with PCC § 10240.8.

The exclusive venue for any arbitration will be in Los Angeles County.

The expenses and fees of the arbitrators and the administrative fees, if any, will be divided among the parties equally. Each party will pay its own counsel fees, witness fees, and other expenses incurred for its own benefit.

7-4.5.9 When Arbitration Decision Becomes Binding

The decision rendered by the arbitrator will become binding upon the parties unless appealed to the Los Angeles County Superior Court pursuant to PCC § 10240.12 within thirty (30) calendar days of the decision. If subsequent litigation results in an award to the party appealing the arbitration that is less than or equal to that of the arbitration decision, or if the litigation results in a decision in favor of the nonappealing party, then the party appealing the arbitration will pay the nonappealing party's attorney's fees and court costs.

7-4.5.10 Appeal to Superior Court – Waiver of Jury Trial

Should a party timely object to the arbitration decision, it may file a petition with the Los Angeles County Superior Court in accordance with California Code of Civil Procedure (“CCP”) §§ 1285, et seq. Notwithstanding the limitations set forth in CCP § 1286.2, the court may vacate, correct, or adjust an arbitration award, and enter judgment in accordance with CCP § 1287.4, for any legal or equitable basis including, without limitation, error of law. The court will apply the substantial evidence standard of review when considering the appeal of an objecting party.

BY EXECUTING THESE CONTRACT DOCUMENTS, THE CONTRACTOR AGREES TO HAVE DISPUTES OR CONTROVERSY CONCERNING THE CONSTRUCTION, INTERPRETATION, PERFORMANCE, OR BREACH OF THESE CONTRACT DOCUMENTS, INCLUDING CLAIMS FOR BREACH OF CONTRACT OR ISSUES OF BAD FAITH DECIDED IN ACCORDANCE WITH THIS SECTION 6-11. BOTH THE CITY AND THE CONTRACTOR WAIVE THEIR RIGHT TO A JURY TRIAL FOR THESE DISPUTES OR ISSUES.

7-4.5.11 AB 626 Claims Process

Claims made by a Contractor for one or more of the following are subject to the claim resolution process set forth in Public Contract Code section 9204:

(A) A time extension, including, without limitation, for relief from damages or penalties for delay assessed by the City under a contract for a Public Works Project.

(B) Payment by the City of money or damages arising from work done by, or on behalf of, the contractor pursuant to the contract for a Public Works Project and payment for which is not otherwise expressly provided or to which the claimant is not otherwise entitled.

(C) Payment of an amount that is disputed by the City.

PART 4 – EXISTING IMPROVEMENTS

SECTION 402 UTILITIES

402-2 PROTECTION

The following subsection is added to Subsection 402-2 of the Greenbook.

402-2.1 Incorrect Location of Utilities

If the Contractor, while performing the Work, discovers utility facilities not identified correctly or not shown in the contract plans or specifications by the City, the Contractor will immediately notify the City and utility owner in writing.

402-4 RELOCATION

The following subsection is added to Subsection 402-4 of the Greenbook.

402-4.1 Responsibility of Utility Removal or Relocation

The City will be responsible to arrange for the removal, repair, or relocation of existing utilities located within the Project limits if such utilities are not correctly identified in the contract plans or specifications by the City. The City will have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation.

402-5 DELAYS

Insert the following:

Actual loss, as used in this Subsection, will be understood to include no items of expense other than idle time of equipment and necessary payments for idle time of workers, cost of extra moving of equipment, and cost of longer hauls. Compensation for idle time of equipment and idle time of workers will be determined by Subsection 402-5.1 and no markup will be added in either case for overhead and profit. The cost of extra moving of equipment and the cost of longer hauls will be paid for as extra work.

402-5.1 Calculating Idle Time

Equipment idle time will be calculated in accordance with Subsection 7-4.2.3 and based upon the actual normal working time during which the delay condition exists, but in no case will exceed 8 hours in any one day. The days for which compensation will be paid will be the calendar days, excluding Saturdays, Sundays and legal holidays,

during the existence of the delay.

Worker idle time will be calculated in accordance with Subsection 7-4.2.3.

- END OF SECTION -

SECTION III – SPECIAL PROVISIONS

1-0. GENERAL SCOPE, TIME FOR COMPLETION, AND LOCATION OF WORK

1-1. General Scope of Work:

The work to be done consists of furnishing all materials, tools, equipment, labor, supervision, incidentals, and related work for renovation improvements as required in the specifications, plans, and contract documents for the following project:
“Teen Center, Plaza, And Skatepark Renovation Project”.

1-2. Location of the Work:

The project will occur at Teen Center at Recreation Park, 405 E Grand Ave, El Segundo, CA 90245

1-3. Working Days and Time for Completion:

Contractor will commence work on date specified in the Notice to Proceed to be issued to the Contractor by City of El Segundo Public Works Department and shall complete work within **Two-Hundred Forty-Five (245)** working days after the date of commencement.

2-0. NOTIFICATIONS

The CONTRACTOR will notify all agencies listed here in a minimum of forty-eight (48) hours before start of operation. The following list of names and telephone numbers are intended for the convenience of the CONTRACTOR and the City does not guarantee either the completeness or correctness of this list.

<u>OPERATION</u>	<u>OFFICE</u>	<u>TELEPHONE</u>
1. Start of work,	Alberto Oliveros, Project Manager	310-765-0820
shutdown of work,	Cheryl Ebert, City Engineer	310-524-2321
or resumption of	Elias Sassoon, Director of Public Works	310-524-2356
work after shutdown		
2. Closing of streets	El Segundo Police Department**	310-524-2200
	El Segundo Fire Department**	310-524-2236

** The **CONTRACTOR** will notify the Engineering Division before notifying these offices.

The following information is provided for **CONTRACTOR'S** use to notify agencies if their

facilities are affected by **CONTRACTOR'S** work:

1. Underground Service Alert (all excavation in public right-of-way) 800-227-2600
2. City of El Segundo – Water Division 310-524-2742
3. City of El Segundo - Wastewater Division 310-524-2754
4. City of El Segundo - Recreation and Parks 310-524-2707
5. Southern California Gas Company 310-671-9002
6. Southern California Edison Company (SCE) 310-417-3366
7. AT&T 310-515-4430
8. Spectrum (Cable) 310-768-0400 Extension 414
9. Los Angeles County Sanitation District 310-699-7411
10. El Segundo Unified School District 310-615-2650

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2-1. NO PARKING NOTIFICATIONS

The CONTRACTOR shall post City-approved temporary NO PARKING notices a minimum of seventy-two (72) hours before the start of operation. The CONTRACTOR shall promptly notify City staff once posting is completed in order to ensure the 72-hour requirement has been met.

The dates and times on the signs shall be site specific and shall cover the minimum time required for “NO PARKING” to facilitate construction. Generic long-term “NO PARKING” time designations are not acceptable. Parking shall not be restricted during any period when construction activity is not scheduled at this particular site.

3-0. MOBILIZATION

Mobilization shall conform to the provisions of Section 7-3.4 of the Standard Specifications. The scope of work under mobilization includes but is not limited to:

1. Obtaining and paying for all required bonds, insurance, permits, and licenses.
2. Completing and submitting required documents as required per specifications.
 3. Moving on to the site of all Contractor’s equipment required for operations.
 4. Installing and removing of all temporary facilities required for operations.
 5. Posting all OSHA required notices.
 6. Submittal of Construction Schedule, Contractor Contact List, and Notices to City staff for City approval
 7. Notification of City staff, residents, businesses and motorists, including temporary warning and safety signage where construction is or will be occurring. Notification shall be furnished by Contractor and shall be distributed seventy-two (72) hours prior to work in that area.
 8. Re-notification of all affected parties for all construction schedule changes

9. Protection of utility facilities, landscapes, pavements, structures, and any existing condition and other public property in place during any construction activities. This includes protection of planter boxes and vegetation.
 10. Restoration, to existing standard conditions or better, of public property damaged during construction
 11. NPDES permit compliance
 12. Bringing unforeseen field conditions to City staff's attention in a timely manner
 13. Removal and disposal of any existing unused materials from the project sites.
 14. Demobilization
- 3-1. Clearing, grubbing, and landscape removal shall take place as necessary for all construction activities to occur, including but not limited to Section 300-1 of the Standard Specifications. If applicable, live tree roots shall be inspected by the Recreation and Parks Division after the surface above them has been removed, to ascertain if tree root barrier installation or full tree removal is necessary. Costs for clearing, grubbing, and landscape/tree root removal shall be included in the bid prices for the different bid items. All such removals shall take place prior to any excavation for construction. Where necessary, the contractor shall replace residential landscaping or sprinklers damaged by construction after construction is complete.
 - 3-2. Underground Service Alert, 1-800-227-2600, shall be contacted and the contractor shall determine the exact location of all utilities prior to beginning excavation and construction. If conflicts are discovered, the Contractor shall notify the Engineer immediately.
 - 3-3. Demobilization shall include all activities for the Contractor to remove all equipment, on-site sanitary facilities, etc. from the project areas after construction is complete. Demobilization shall also include general cleanup activities and punch list items and specific activities determined by the City Public Works Inspector, to repair or replace any private or public facilities damaged by the construction and to return City property to the same or better condition as that existing prior to construction.
 - 4-0. CONSTRUCTION & DEMOLITION MATERIALS RECYCLING REQUIREMENTS

The Contractor shall divert all Construction and Demolition (C&D) waste generated from the project in accordance with the California Green (CALGreen) Building Standards Code (pursuant to El Segundo Municipal Code, Title 13, Chapter 11). C&D waste can only be legally collected, removed, or transported by City of El Segundo permitted waste haulers. If the Contractor plans on collecting, removing, or transporting its own waste, approval from the City Engineer or designee is required.

Failure to meet the C&D waste recycling requirements will result in the assessment of penalties pursuant to El Segundo Municipal Code.

Contractor shall prepare a C&D Debris Management Plan as follows:

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following: procedures for ensuring optimal diversion of construction and demolition (C&D) waste materials generated by the Work within the limits of the Construction Schedule and Contract Sum.
1. The Integrated Solid Waste Management Act of 1989 ("AB 939"), requires that localities throughout the state develop source reduction, reuse, recycling, and composting programs to reduce the tonnage of solid waste disposed in landfills by 50%; this requirement may increase in the future. C&D waste materials generated by the Work are targeted to achieve these diversion rates.
 2. A minimum of 50% by weight of the solid wastes generated in the Work shall be diverted from landfill disposal through a combination of reuse, recycling, and composting activities.
 3. This section includes requirements for submittal of C&D Debris Management Plan prior to the commencement of the Work, and during the project, submittal of Contractor's quantitative reports for construction and demolition waste materials generated by the Contractor as a condition of approval of progress payments submitted to the Contracting Officer, and following completion of the project, as a condition of the release of final project retention.

1.2 DEFINITIONS

- A. Class III Landfill. A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the California Department of Resources Recycling and Recovery (CalRecycle) and be regulated by the Enforcement Agency.
- B. Construction and Demolition Debris or C&D Debris. Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous as defined in California Code of Regulations, Title 22, Section 66261.3 et seq. This term includes, but is not limited to, asphalt, concrete, Portland cement, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The debris may be commingled with rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- C. Contracting Officer. The City of El Segundo City Engineer or designee.
- D. C&D Recycling Center. A facility that receives only C&D material that has been separated for reuse prior to receipt, in which the residual (disposed) amount of waste

in the material is less than 10% of the amount separated for reuse or recycling, by weight.

- E. Disposal. Final deposition of C&D or inert debris into land, including stockpiling onto land of construction and demolition debris that has not been sorted for further processing or resale, if such stockpiling is for a period of time greater than 30 days; and construction and demolition debris that has been sorted for further processing or resale, if such stockpiling is for a period of time greater than one year, or stockpiling onto land of inert debris that is for a period of time greater than one year.
- F. Diversion or Divert. The reuse or recycling of construction and demolition debris to avoid disposal in a landfill.
- G. Enforcement Agency (EA). Enforcement agency as defined in Public Resources Code 40130.
- H. Inert Disposal Facility or Inert Waste Landfill. A disposal facility that accepts only inert waste such as soil and rock, fully cured asphalt paving, uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete), brick, glass, and ceramics, for land disposal.
- I. Inert Solids or Inert Waste. Non-liquid solid wastes including, but not limited to, soil and concrete that do not contain hazardous waste or soluble pollutants at concentrations in excess of water quality objectives established by a regional Water Board pursuant to Division 7 (Sections 13000 et seq) of the California Water Code and does not contain significant quantities of decomposable solid resources.
- J. Mixed C&D Debris. Loads that include commingled recyclable and non-recyclable C&D debris generated at the construction site.
- K. Mixed Debris Recycling Facility. A processing facility that accepts loads of solid waste and/or recycling materials for the purpose of recovering reusable, recyclable, and compostable materials and disposing the non-recyclable residual materials.
- L. Recycling. The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
- M. Reuse. The use of a material that might otherwise be discarded, in the same or similar form as it was produced.
- N. Separated for Reuse. Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream for the purpose of additional sorting or processing of those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw material for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace, and includes materials that have been “source separated.”

- O. Solid Waste. Refer to Public Resources Code Section 40191.
- P. Source-Separated. Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream at the point of generation, for the purpose of additional sorting or processing of those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 SALVAGE, REUSE, RECYCLING AND PROCEDURES

- A. Identify reuse, salvage, and recycling facilities: Refer to the City's website for a list of local organizations and companies.

<https://www.elsegundo.org/government/departments/public-works/trash-recycling>

- B. Develop and implement procedures to reuse, salvage, and recycle new construction and excavation materials, based on the Contract Documents, the C&D Debris Waste Management Plan, estimated quantities of available materials, and availability of recycling facilities. Procedures may include on-site recycling, source separated recycling, and/or mixed debris recycling efforts.
 - 1. Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.
 - 2. Explore the possibility of reusing project job-site inert materials, such as rock, concrete, dirt and aggregate, on-site for road base or other similar uses.
 - 3. Source separate new construction, excavation and demolition materials including, but not limited to the following types:
 - a. Asphalt
 - b. Concrete, concrete block, slump stone (decorative concrete block), and rocks.
 - c. Red Clay Brick
 - d. Soils
 - e. Other materials, as appropriate, such as wood and corrugated cardboard.

4. Develop and implement a program to transport loads of mixed (commingled) new construction materials that cannot be feasibly source-separated to a mixed materials recycling facility.
5. Contractor may develop their own C&D Debris Management Plan based on CALGreen requirements or use available City forms as follows:
 - a. Form PW-A – Project Information
 - b. Form PW-B – Pre-Project Worksheet
 - c. Form PW-B1 – Pre-Project Worksheet (This form is to be completed only if you plan to use your own company-owned bins/trucks for disposition of material.)
 - d. Form PW-C – Post-Project Summary
 - e. Form PW-D – Exemption Request – only use if it is infeasible to comply with requirements.

3.2 DISPOSAL OPERATIONS AND WASTE HAULING

- A. Legally transport and dispose of materials that cannot be delivered to a source-separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.
- B. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, visit the City of El Segundo website:
<https://www.elsegundo.org/government/departments/public-works/trash-recycling>
- C. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.
- D. Legally transport and deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, or composting.
- E. Do not burn, bury or otherwise dispose of solid waste on the project job-site.

3.3 REUSE AND DONATION OPTIONS

- A. Implement a reuse program to the greatest extent feasible. Options for reuse may include, but are not limited to:
 1. Los Angeles County Materials Exchange (LACOMax) LACoMAX is a free service provided by the Los Angeles County Department of Public Works, Environmental Programs Division, designed to help residents, businesses, and organizations in Los Angeles County find markets for their industrial by-products, surplus materials, and other would-be discards. All exchanges are

coordinated between the parties. The site can be accessed at <http://www.ladpw.org/epd/lacomax>.

2. California Materials Exchange (CalMAX) is a free service provided by the State of California, Department of Resources Recycling and Recovery (CalRecycle) that connects businesses, organizations, manufacturers, schools, and individuals with online resources for exchanging materials. The site can be accessed at www.calrecycle.ca.gov/CalMAX.
 3. Habitat for Humanity ReStore resale outlets accept donated home improvement goods like furniture, home accessories, building materials and appliances. The materials are sold to the general public. The proceeds help local Habitat affiliates fund the construction of Habitat homes within their communities. Locations of ReStores can be found at: www.habitat.org/restores.
- 3.4 REVENUE
- A. Revenues or other savings obtained from recycled, re-used, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents.

- END SECTION -

5-0. WORK SCHEDULE

Contractor shall be responsible for providing a workable construction schedule that incorporates the following conditions:

1. The schedule for the work is subject to the approval of the Public Works Department.
2. All work shall take place Monday through Friday between the hours of 7:00 am and 4:00 pm unless previously approved by the Public Works Director, City Engineer, or Project Engineer for any other day of the week.
3. The Contractor shall coordinate all inspections and final sign-offs for permits and the project with Public Works Department staff.

6-0. EXAMINATION OF JOB SITE AND MEASUREMENT VERIFICATION

The BIDDER shall make a detailed physical inspection of the project site before submitting the proposal. It is understood that the BIDDER has thoroughly examined the specifications, sites and conditions under which work will be performed before submitting a proposal and has satisfied himself regarding existing conditions and existing access conditions which may affect bid prices for the proposed work.

Measurement Verification: Contractor shall verify all field measurements and

determine quantities prior to ordering materials. Contractor shall procure all material and confirm all parts are onsite prior to beginning installation.

7-0. INSPECTION

Section 3-5 of the Specifications is supplemented by the following additional requirements:

1. On all questions relating to quantities, the acceptability of material, or work, the execution, progress or sequence of work, and the interpretation of specifications or plans, the decision of the Engineer or City Inspector is final and binding, and shall be precedent to any payment under the contract.
2. All work and materials are subject to inspection and approval of the Engineer or City Inspector.
3. Legible copies of material/weight certification shall be turned over to the City Inspector on a daily basis.
4. Inspection of the work shall not relieve the Contractor of the obligations to fulfill all conditions of the contract.

8-0. WORK AREA SAFETY

All work shall conform to all applicable State, local, regional and Federal codes, ordinances, and regulations as prescribed by the City.

1. The Contractor shall conform to the rules and regulations pertaining to safety established by the California Division of Occupational Safety and Health of the Industrial Relations Department (CAL-OSHA).
2. The CONTRACTOR shall place and maintain signs, cones, barricades, security fences, and other safety devices as needed for the safety of and the general public, City personnel, and the Contractor.

8-0. USE OF PRIVATE PROPERTY AND PROTECTION OF EXISTING IMPROVEMENTS

The use of any private property or utilities on private property by the Contractor is prohibited. The prohibited uses include, but not limited to Contractor's use of water, electricity or natural gas from the private property, and storage of material or equipment, and turning around/parking of his vehicles on private property.

1. Existing public and/or private improvements, adjacent property, utility and other facilities and trees and plants shall be protected from injury or damage.
2. Any damage to the facilities, public, or private property that takes place as

a result of the contractor's work shall be repair or replaced to the City's satisfaction by the contractor at no cost to the City.

3. Access to driveway shall be maintained at all times for residents.

9-0. STORAGE OF MATERIALS AND EQUIPMENT

1. No material or equipment shall be stored in public right-of-way.
2. The contractor shall be responsible for obtaining a site for storage of material and equipment. The site shall not be within or adjoining the residential areas of the City. Site shall be subject to approval by the City.
3. The sites for stockpiling and batching materials shall be clean and free from objectionable material.
4. The City does not have nor does it guarantee any designated property within the City for storage of materials.
5. If the Contractor finds a private property for storage of his materials, the Contractor shall furnish the City a letter of approval and a letter of release (at the end of the job and cleanup of the storage site) from the property owner for this purpose.

10-0. DISPOSAL OF REMOVALS

There are no authorized dump facilities within the City of El Segundo. All removed material shall become the property of the Contractor and shall be legally disposed of by Contractor at the end of each work day away from the site of work.

11-0. PUBLIC WORKS ENCROACHMENT PERMITS AND BUILDING PERMITS

The Contractor will be required to apply and obtain applicable permits from the Public Works and Community Development Departments. The Contractor's work shall adhere to the City standards and applicable codes including the California Building Code, Plumbing Code, Electrical Code, and Mechanical Code. The Contractor shall call the Inspector at least 24 hours in advance for inspections.

All noted deficiencies on permits shall be corrected by contractor. The project will not be accepted as complete until contractor obtains a final sign-off for all permits.

12-0. NPDES COMPLIANCE

Contractor shall comply with the latest version of the Los Angeles Regional Water Quality Control Board (LA RWQCB) NPDES MS4 Permit for storm water and non-storm water discharges.

Contractor shall not discharge or permit to be discharged to any street, channel, river, storm drain, or any appurtenances thereof, any non-rain water or other liquid substance from the project or from operations pertaining to the project site, unless the discharge is specifically listed as exempt or conditionally exempt in the most current MS4 Permit issued by the Regional Water Quality Control Board, Los Angeles Region.

Contractor shall implement all necessary Best Management Practices (BMPs) to ensure that any conditionally exempt discharge meets all current requirements of the LA RWQCB MS4 Permit.

City may prohibit or restrict any discharge if, in its sole discretion, the discharge is polluting, unsafe, or causes a nuisance condition to be created.

Depending on the size of the project and/or construction activities of the project, the Contractor may be required to comply with the State Water Resources Control Board (SWRCB) Construction General Permit (Adopted Order 2009-0009-DWQ and subsequent amendments). Contractor shall refer to the SWRCB Construction General Permit for construction activities covered and be responsible for implementing requirements if subject to the Construction General Permit.

13-0. COMPLETION

Upon completion of work at each site, the Contractor shall conduct careful inspection with the City Inspector and shall correct all defective work to the satisfaction of the Owner.

The Contractor shall coordinate all inspections and final sign-offs for Encroachment Permits with City staff.

All scrap, litter and debris resulting from operations specified herein, shall be removed and the premises left in a clean and satisfactory condition.

14-0. WARRANTY

The Contractor and/or manufacturer shall warrant all work performed under this Contract for a minimum of one (1) years from the date of Owner's acceptance of completed job. Any defects in materials or workmanship appearing during this period shall be corrected without cost to the City.

- END OF SECTION -

EXHIBIT A

Technical Specifications

CITY OF EL SEGUNDO

BID PACKAGE

SPECIFICATIONS

FOR

**EL SEGUNDO RECREATION PARK
PHASE 1 IMPROVEMENT PROJECT
TEEN CENTER AND TEEN PLAZA
PROJECT NO.: PW 25-13**

405 E GRAND AVE. EL SEGUNDO, CA 90245

**PREPARED FOR
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
350 MAIN STREET
EL SEGUNDO, CA 90245
310-524-2300**

**PREPARED BY
MIG, INC.
360 EAST SECOND STREET, SUITE 675
LOS ANGELES, CA 90012**

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SECTION 01 50 50 - EROSION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
 - 1. Apply specified treatments to all cuts and fill slopes, soil stockpiles, and all disturbed areas.
 - 2. Install all temporary erosion control devices per Plans and Specifications.
- B. All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements

1.3 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, 2015
 - 1. Section 21, Erosion Control
- B. Association of Official Seed Analysts Procedures
- C. California State Seed Law of the Department of Food and Agriculture

1.4 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit, in accordance with Section 01 10 00, Supplemental General Requirements, manufacturer's letters of compliance and manufacturer's literature for the following items:
 - 1. Seed Mixes (or individual items)
 - 2. Mulches
 - 3. Binders/Tackifiers
 - 4. Fertilizer
 - 5. Humate
 - 6. Soil inoculates
 - 7. Straw (Weight receipts from scales shall be required)
 - 8. Erosion Control Blanket

1.5 SITE CONDITION

- A. It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent

public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.

- B. It is the responsibility of the Contractor to have finished the grading of the slopes, including track walking the areas to be treated with erosion control treatments.

1.6 WORK SCHEDULE

- A. The Contractor shall proceed with work per the construction schedule. The work shall progress as soon as the site becomes available consistent with normal seasonal limitations.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.
- B. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

1.8 ANALYSIS OF SAMPLES AND TESTS

- A. Samples: The City reserves the right to take and analyze samples of materials for conformity to the Specifications at any time.
- B. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the City or City's representative prior to job site delivery.

2.2 MULCH

- A. Mulch shall be 100% wood hydroseed and shall be composed of wood fiber derived from whole wood chips with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form a homogeneous slurry which is capable of being sprayed to form a porous mat.
- B. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these Specifications.

2.3 STRAW

- A. Shall be derived from irrigated rice or clean cereal grain straw.
- B. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the County in which it is to be used is delivered to the site of the work.
- C. Straw that has been used for bedding is prohibited.

2.4 EQUIPMENT

- A. Straw blowers: Equipment shall be specifically designed and manufactured for the application of straw and shall be of sufficient horsepower to break up and distribute straw at the specified application rate.

2.5 WATER

- A. Water shall be furnished by the Contractor. Water shall be of potable quality.
- B. Erosion control must be Erosion Control Technology Council (ECTC) Type 2D and made of processed natural fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by 2 natural nets. Erosion control blanket must comply with the requirements shown in the following table:

Erosion Control Blanket

Quality characteristic	Test method	Requirement		
		Type A	Type B	Type C
Roll width (min, inches)	--	72		
Matrix (%)				
Straw/coconut		70/30	--	--
Woven coir (coconut fiber)	--	--	100	--
Wood excelsior (6 inches or longer)		--	--	80
USLE C-Factor for a 1:1 (H:V) unvegetated slope	--	≤ 0.20		
Shear stress (max, psf)	ASTM D6460	1.75		
Tensile strength (min, psf)	ASTM D5035	75		
Functional longevity (months)	--	12		

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. No soil amendments shall be required except as noted on the Plans.

- B. Verification: Contractor shall verify:
1. That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
 2. That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
 3. That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.2 EROSION CONTROL BLANKET INSTALLATION

- A. Before placing the erosion control blankets, Contractor shall ensure the subgrade has been graded smooth and has no depressed voids. The subgrade must be free from obstructions, such as tree roots, projecting stones, or foreign matter greater than 1 inch in diameter. Overlap the end of the erosion control blanket by 24 inches. Use 18 inch staples staked at maximum of 4 feet on center in staggered pattern. Do not drive vehicles on the erosion control blanket.

3.3 PLANT ESTABLISHMENT MAINTENANCE

- A. General plant maintenance shall immediately follow seeding and continue for **90 days**.
- B. Protect areas against all damage, including erosion and trespass, and provide proper safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespassing. Check all barrier and temporary fencing daily, and make immediate repairs or replacements
- C. Repair all damage to seeded areas.
- D. Maintain constant moisture depth in soil to insure vigorous growth.

3.4 FINAL INSPECTION AND ACCEPTANCE:

- A. Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the City's Representative, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.5 GUARANTEE AND REPLACEMENT

- A. Guarantee all planting to be in a healthy, thriving condition until the end of the maintenance period or beyond that time until active growth is evident and for one year from date of acceptance.
- B. Replace all seeded areas not in vigorous condition as soon as directed by City's Representative. Seed mixture used for replacement must be of the same kind and quantity as specified in this section.

3.6 CLEAN-UP

- A. Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.
- B. Overspray: Installing Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.
- C. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

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SECTION 03 10 00 – CONCRETE FORMING FOR SKATEPARKS

PART 1 - GENERAL

1.1 SUMMARY:

- A. All formwork in this section is considered specialty skatepark construction. Please see Bidder Qualifications for contractors eligible to perform this work as specified herein. Bidder Qualification Forms must be turned in with the bid.

1.2 DESCRIPTION:

- A. Construct all formwork to follow skatepark drawings, unless otherwise approved by the Engineer. Construct formwork to allow for removal without damaging finished concrete surfaces.

1.3 RELATED SECTIONS:

- B. SECTION 03 20 00 - CONCRETE REINFORCING FOR SKATEPARKS
- C. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE FOR SKATEPARKS
- D. SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS
- E. SECTION 03 39 00 – CONCRETE CURING FOR SKATEPARKS

PART 2 – PRODUCTS

- A. FORM MATERIALS: PLYWOOD, METAL, METAL-FRAMED PLYWOOD, OR OTHER APPROVED PANEL-TYPE MATERIALS FREE FROM DEFECTS AND DISTORTION, AND TO PROVIDE FULL-DEPTH, CONTINUOUS, STRAIGHT, SMOOTH EXPOSED SURFACES.
- B. USE FLEXIBLE OR CURVED FORMS AS REQUIRED TO PROVIDE VERTICAL AND HORIZONTAL RADII AS INDICATED IN THE DRAWINGS.
- C. PROVIDE 2" NOMINAL THICKNESS, SURFACED PLANK WOOD FORMS FOR STRAIGHT SECTIONS. USE FLEXIBLE METAL, 1" LUMBER, OR PLYWOOD FORMS FOR RADIUS BENDS. DO NOT OVERLAP FORMS, CREATING AN OFFSET FINISHED EDGE.
- D. FORM-RELEASE AGENT: COMMERCIALY FORMULATED FORM-RELEASE AGENT THAT WILL NOT BOND WITH, STAIN, OR ADVERSELY AFFECT CONCRETE SURFACES AND WILL NOT IMPAIR SUBSEQUENT TREATMENTS OF CONCRETE SURFACES.

PART 3 - EXECUTION

- A. EDGE FORMS AND SCREED CONSTRUCTION

1. SET, BRACE, AND SECURE EDGE FORMS, BULKHEADS, AND INTERMEDIATE SCREED GUIDES FOR PAVEMENT TO REQUIRED LINES, GRADES, AND ELEVATIONS. INSTALL FORMS TO ALLOW CONTINUOUS PROGRESS OF WORK.
- B. DO NOT OVERLAP FORMS, CREATING AN OFFSET FINISHED EDGE.
- C. CLEAN FORMS AFTER EACH USE AND COAT WITH FORM RELEASE AGENT TO ENSURE SEPARATION FROM CONCRETE WITHOUT DAMAGE.

END OF SECTION 03 10 00

SECTION 03 10 00 – CONCRETE FORMING FOR SKATEPARKS

PART 1 - GENERAL

1.1 SUMMARY:

- A. All formwork in this section is considered specialty skatepark construction. Please see Bidder Qualifications for contractors eligible to perform this work as specified herein. Bidder Qualification Forms must be turned in with the bid.

1.2 DESCRIPTION:

- A. Construct all formwork to follow skatepark drawings, unless otherwise approved by the Engineer. Construct formwork to allow for removal without damaging finished concrete surfaces.

1.3 RELATED SECTIONS:

- B. SECTION 03 20 00 - CONCRETE REINFORCING FOR SKATEPARKS
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- A. FORM MATERIALS: PLYWOOD, METAL, METAL-FRAMED PLYWOOD, OR OTHER APPROVED PANEL-TYPE MATERIALS FREE FROM DEFECTS AND DISTORTION, AND TO PROVIDE FULL-DEPTH, CONTINUOUS, STRAIGHT, SMOOTH EXPOSED SURFACES.
- B. USE FLEXIBLE OR CURVED FORMS AS REQUIRED TO PROVIDE VERTICAL AND HORIZONTAL RADII AS INDICATED IN THE DRAWINGS.
- C. PROVIDE 2" NOMINAL THICKNESS, SURFACED PLANK WOOD FORMS FOR STRAIGHT SECTIONS. USE FLEXIBLE METAL, 1" LUMBER, OR PLYWOOD FORMS FOR RADIUS BENDS. DO NOT OVERLAP FORMS, CREATING AN OFFSET FINISHED EDGE.
- D. FORM-RELEASE AGENT: COMMERCIALY FORMULATED FORM-RELEASE AGENT THAT WILL NOT BOND WITH, STAIN, OR ADVERSELY AFFECT CONCRETE SURFACES AND WILL NOT IMPAIR SUBSEQUENT TREATMENTS OF CONCRETE SURFACES.

PART 3 - EXECUTION

- A. EDGE FORMS AND SCREED CONSTRUCTION

1. SET, BRACE, AND SECURE EDGE FORMS, BULKHEADS, AND INTERMEDIATE SCREED GUIDES FOR PAVEMENT TO REQUIRED LINES, GRADES, AND ELEVATIONS. INSTALL FORMS TO ALLOW CONTINUOUS PROGRESS OF WORK.
- B. DO NOT OVERLAP FORMS, CREATING AN OFFSET FINISHED EDGE.
- C. CLEAN FORMS AFTER EACH USE AND COAT WITH FORM RELEASE AGENT TO ENSURE SEPARATION FROM CONCRETE WITHOUT DAMAGE.

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCING FOR SKATEPARKS

PART 1 - GENERAL

1.1 SUMMARY:

- A. All work in this section is considered specialty skatepark construction. Please see Bidder Qualifications for contractors eligible to perform this work as specified herein. Bidder Qualification Forms must be turned in with the bid.
- B. All reinforcement to follow drawings, unless otherwise approved by the Engineer.

1.2 REFERENCE STANDARDS:

- A. All reinforcing steel shall conform to ASTM A-615 Grade 60.
- B. For reinforcing that is to be welded, conform to ASTM A706 Grade 60.
- C. Use ASTM A-108 Grade 60 for all welded anchors.
- D. Comply with CRSI's Manual of Standard Practice for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- E. Latest ACI code and detailing manual apply.

1.3 RELATED SECTIONS:

- A. SECTION 03 10 00 - CONCRETE FORMING FOR SKATEPARKS
- B. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE FOR SKATEPARKS
- C. SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS
- D. SECTION 03 39 00 – CONCRETE CURING FOR SKATEPARKS

PART 2 – PRODUCTS

- A. Joint dowel bars: Plain steel dowels, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- B. Speed dowels or similarly manufactured dowel sleeves are acceptable.
- C. Bar supports: Bolsters, chairs, spacers and other devices for spacing, supporting, and fastening reinforcement bars, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

PART 3 - EXECUTION

- A. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- B. All reinforcing bars to be deformed. Latest ACI code and detailing manual apply. Clear concrete coverages to any reinforcing including ties are as follows:
 - 1. 2" – Formed concrete exposed to earth or weather.
 - 2. 1" – Slabs and joints not exposed to weather.
 - 3. 1-1/2" – All other.
- C. Tension lap splices in concrete: Unless noted otherwise, provide the following:
 - 1. #3, 22"; #4, 29"; #5, 36". Multiply by 1.3 for top bars.
- D. Minimum clear cover for spliced reinforcing is 2". Splice bottom bar over supports and top bar at midspan only. Where bars are shown spliced, they may run continuous at contractor's option.
- E. Place rebar per CRSI Manual. Rebar spacings given are maximum on center whether stated as "o.c." or not, and all rebar is continuous whether stated as "cont." or not. Provide bent corner rebar to match and lap with horizontal rebars at corners and intersection of walls, beams, bond beams and footings per ACI Manual. Dowel all vertical rebar to foundations. Securely tie all rebar, including dowels, in location before placing concrete or grout.

END OF SECTION 03 20 00

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE FOR SKATEPARKS

PART 1 - GENERAL

1.1 SUMMARY:

- A. All concrete work in this section is considered specialty skatepark construction. Please see bidder qualifications for contractors eligible for the work as specified herein. Bidder qualification forms must be turned in with the bid.
- B. Place all concrete to follow skatepark drawings, unless otherwise approved by the engineer.

1.2 REFERENCE STANDARDS:

- A. Concrete shall meet the requirements of ACI 301 with Type I/II/IL cement except as noted herein.
- B. Slab construction shall conform to ACI 302.1 except as noted herein.

1.3 RELATED SECTIONS:

- A. SECTION 03 10 00 - CONCRETE FORMING FOR SKATEPARKS
- B. SECTION 03 20 00 - CONCRETE REINFORCING FOR SKATEPARKS
- C. SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS

1.4 QUALITY CONTROL:

- A. Concrete cylinders shall be taken and tested per the ACI code, when required by the project.

PART 2 – PRODUCTS

- A. Concrete shall meet the requirements of ACI 301 with Type I/II/IL cement. Minimum 28-day strength 4,000 psi, except as follows:
 - 1. Type I/II/IL cement, minimum 28-day strength 4,000 psi
 - 2. Small to medium aggregate (3/4" max.)
 - 3. Mix design(s) containing fly ash: the amount of fly ash/slag used shall not exceed 20% by weight of the combined weight of fly ash/slag plus cement.
 - 4. Air entrainment not to exceed 3%.
 - 5. Water/cement ratio of .45 or less
 - 6. Provide mix design(s) that will meet the minimum requirements listed herein.

PART 3 - EXECUTION

3.1 CONCRETE PLACEMENT:

- A. Do not install concrete work over saturated, muddy, or frozen subgrade.
- B. Protect adjacent work and provide temporary barricades as required for protection of project work and public safety.
- C. All reinforcing, including dowels and anchor bolts, shall be securely tied in location before placing concrete or grout. Dowels will not be allowed to be "stabbed" in.
- D. Conduits, pipes, and sleeves embedded in concrete shall conform to the requirements of ACI 6.3.
- E. Mechanically vibrate all concrete flatwork when placed, except that slabs on grade and slabs on deck need to be vibrated only around embedded items.
- F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- G. Cold weather placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- H. Hot-weather placement: Place concrete according to recommendation in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 100°F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is contractor's option.
 - 2. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

- I. Finish: All exposed concrete surfaces are to receive hard steel trowel finish unless otherwise noted. Trowel until all visible pores are closed. Cease troweling before surface becomes glossy. Do not broom finish and do not trowel burn surface.

- 1. All edge tooling should be 1/8 inch radius unless otherwise specified.

- J. Color: All concrete surfaces are to be natural gray color unless otherwise noted. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable. Do not broom finish and do not trowel burn surface.

3.2 PAVEMENT TOLERANCES:

- A. Contractor must achieve positive drainage for all surfaces within the skatepark area—level to a tolerance of ¼ inch in 10 feet when tested with a 10-foot steel straightedge placed on the surface. Standing water will not be allowed. (Refer to civil grading plan)

3.3 REPAIRS AND PROTECTION:

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this section. The contractor shall fix all cracks and displacements larger than 1/8" up to the project completion.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 03 30 00

SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS

PART 1 – GENERAL

1.1 SUMMARY

A. Specialty Construction

Shotcrete application, cutting, sculpting, and finishing for skatepark construction is deemed **specialty construction**. All work related to shotcrete skatepark construction shall be coordinated by the Project Engineer and performed by a **pre-qualified specialty skatepark contractor** prior to commencement of work.

1.2 QUALITY ASSURANCE

A. Standards

Comply with the latest editions of the following codes and standards, except as modified herein:

1. International Building Code (IBC)
2. American Concrete Institute (ACI):
 - ACI 506 – Specification for Shotcrete
 - ACI 506R – Guide to Shotcrete
 - ACI 506.2 – Shotcrete Crew Qualifications
3. ASTM Standards as referenced herein

B. Installer Qualifications

The contractor placing shotcrete **shall be the same contractor installing precast skate elements**, unless otherwise approved in writing.

C. Personnel Qualifications

Shotcrete nozzleman shall be **ACI-certified** and experienced in skatepark construction.

1.3 SUBMITTALS

- A. Manufacturer's data for all admixtures and proprietary materials.
- B. Shotcrete mix designs.
- C. Nozzleman certification documentation.

1.4 REFERENCE STANDARDS

- ACI 211.1 – Selecting Proportions for Normal Weight Concrete
- ACI 301 – Specifications for Structural Concrete
- ACI 305 – Hot Weather Concreting
- ACI 306 – Cold Weather Concreting
- ACI 318 – Building Code Requirements for Structural Concrete
- ASTM C33, C94, C143, C150, C260, C494, C618

1.5 JOB CONDITIONS

- A. Coordinate concrete schedules with reinforcing, forming, embedded steel, earthwork, and finishes.
 - B. Verify placement of all embedded items prior to shotcrete application.
 - C. Coordinate slopes, grades, and drainage per drawings.
-

PART 2 – PRODUCTS

2.1 SHOTCRETE MIX DESIGN

- A. Comply with ACI 506 and ACI 506.2.
- B. Type I/II/IL cement.
- C. Minimum 28-day compressive strength: **4,000 psi**.
- D. Fly ash or slag not to exceed **20%** of total cementitious material.
- E. Air entrainment not to exceed **3%**.
- F. Water-cement ratio $\leq$ **0.45**.

2.2 APPLICATION EQUIPMENT

- A. Wet-mix shotcrete equipment capable of continuous placement.
 - B. Clean, adequate air supply.
 - C. Delivery hose sized and maintained to ensure uniform flow and velocity.
-

PART 3 – EXECUTION

3.1 INSPECTION

- A. Verify formwork alignment, bracing, and tolerances.
- B. Examine existing concrete surfaces and remove unsound material.
- C. Notify other trades in advance of placement.

3.2 PREPARATION

- A. Apply form-release to removable forms to prevent bonding.
- B. Ensure surfaces are clean and dampened to SSD condition prior to placement.

3.3 BATCHING AND MIXING

- A. Proportion materials by weight.
- B. Concrete temperature at placement shall not exceed **100°F** unless approved.

3.4 PLACEMENT

- A. Place shotcrete using methods ensuring full encapsulation of reinforcement.
- B. Maintain nozzle perpendicular to surface as practical.
- C. Begin wall placement at bottom and build upward.
- D. Layer placement shall allow initial set between passes.
- E. **Radial templates** required to verify skate radii; check every horizontal foot.
- F. Rebound material shall be removed and **not reused**.

3.5 DEFECT REMOVAL

Remove and replace shotcrete exhibiting segregation, voids, laminations, or poor consolidation.

3.6 FINISHING

- A. Hard steel trowel finish required.
- B. Grinding is **not acceptable** to correct geometry.
- C. Color to be **natural gray**, unless otherwise specified.
- D. Maintain concrete above **40°F** and moist for curing.

3.7 JOINTS

- A. Clean and wet joints prior to additional shotcrete placement.
- B. Continue reinforcement through joints.

3.8 CRACKING

- A. Cracking due to inadequate curing is not acceptable.
- B. Cracks and displacements greater than **1/8 inch** shall be repaired prior to project completion.

SECTION 03 40 00 - PRECAST CONCRETE FOR SKATEPARKS

(Including Pool Coping Systems)

1.0 GENERAL

1.1 SPECIALTY SKATEPARK CONSTRUCTION

All work contained in this Section is considered **specialty skatepark construction**.

Precast concrete skate elements and pool coping systems are integral components of the skatepark and shall be installed as part of a coordinated, continuous, rideable skate surface.

Manufacturers and installers shall meet the experience requirements outlined in the **Bidder's Qualifications** section.

1.2 SCOPE OF WORK

Provide all labor, materials, fabrication, transportation, delivery, placement, installation, and coordination necessary to furnish and install **precast concrete skate elements and pool coping systems** as shown on the Drawings and specified herein.

Work includes, but is not limited to:

- Monolithic precast concrete skate elements
 - Manufactured cementitious **pool coping units**
 - Anchoring, alignment, and integration with shotcrete and cast-in-place concrete
 - Coordination of tolerances, radii, transitions, and surface continuity
-

1.3 BASIS OF DESIGN – PRECAST CONCRETE SKATE ELEMENTS

Precast concrete skate elements shall be based on products manufactured by **Spohn Ranch Skateparks**, as the **Basis of Design, or approved equal**, meeting all requirements of this Section.

The Basis of Design establishes the minimum acceptable standard for:

- Monolithic precast skate elements
- Dimensional accuracy and tight tolerances suitable for skateboarding
- Integration with shotcrete skate features and pool coping systems
- Durability, finish quality, and long-term skate performance

Proposed alternate precast systems shall be subject to Owner review and approval and shall demonstrate full compliance with all requirements of the Contract Documents.

1.4 MANUFACTURER INFORMATION – BASIS OF DESIGN

Basis of Design Manufacturer (Precast Concrete Skate Elements):

Spohn Ranch Skateparks

Los Angeles, California

Phone: (626) 330-5803

Email: info@spohnranch.com

Other manufacturers proposing precast concrete skate elements as an approved equal shall meet all requirements of this Section and shall be subject to Owner approval.

1.5 QUALITY ASSURANCE

Installer Experience

The installer shall have a minimum of **five (5) years of experience** installing:

- Monolithic precast concrete skate elements, and
- **Pool coping systems integrated with shotcrete skate features**

Coordination Requirement

The contractor responsible for placing shotcrete shall also be responsible for the installation and coordination of precast skate elements and pool coping systems, unless otherwise approved in writing by the Owner.

2.0 PRODUCTS

2.1 PRECAST CONCRETE SKATE ELEMENTS AND POOL COPING

Precast Concrete Skate Element Requirements:

- Monolithic, factory-produced concrete components
- Steel reinforcement and fiber reinforcement as required
- Controlled-environment curing
- Minimum compressive strength: **4,000 psi at 28 days**
- Manufactured to tight tolerances suitable for skatepark applications

Pool Coping:

- Pool coping units shall be manufactured cementitious products suitable for skatepark use
- Units shall maintain consistent geometry, edge alignment, and transition tolerances
- Pool coping shall integrate seamlessly with adjacent shotcrete and cast-in-place concrete

Finish:

- Riding surfaces shall be hand-finished smooth
 - Transitions between precast elements, pool coping, and shotcrete shall be continuous and free of lippage
-

3.0 EXECUTION**3.1 INSTALLATION**

Install precast concrete skate elements and pool coping units in strict accordance with approved shop drawings and manufacturer recommendations.

All joints between precast elements, pool coping, shotcrete, and cast-in-place concrete shall be coordinated to achieve a continuous, rideable surface.

Grinding shall **not** be used to correct misalignment or improper geometry.

3.2 PROTECTION AND REPAIR

Precast elements or pool coping units that are cracked, damaged, misaligned, or otherwise defective shall be removed and replaced.

Protect installed elements until Final Acceptance.

END OF SECTION 03 37 13

SECTION 03 40 00 – PRECAST CONCRETE FOR SKATEPARKS

PRE-CAST CONCRETE SKATEPARK COMPONENTS

PART 1 - GENERAL

1.1 SPECIALTY SKATE PARK CONSTRUCTION:

- A. All work contained in this section is specialty skate park construction. Manufacturers and installers must meet the minimum experience requirements contained in the quality assurance section.

1.2 GENERAL CONDITIONS:

- A. Requirements of the contract documents, including but not limited to, the general, special, and technical provisions, apply to work in this section as if restated completely herein.

1.3 SCOPE OF WORK:

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all pre-cast concrete skate elements related to the skate park as indicated on the drawings complete as shown and as specified herein.

1.4 BASIS OF DESIGN:

- A. Precast concrete skate elements shall be based on products manufactured by Spohn Ranch Skateparks, as the Basis of Design, or approved equal, meeting all requirements of this Section. The Basis of Design establishes the minimum acceptable standard for:

1. Monolithic precast skate elements
2. Dimensional accuracy and tight tolerances suitable for skateboarding
3. Integration with shotcrete skate features and pool coping systems
4. Durability, finish quality, and long-term skate performance

- B. Proposed alternate precast systems shall be subject to Owner review and approval and shall demonstrate full compliance with all requirements of the Contract Documents.

1.5 REFERENCES:

- A. Comply with the applicable reference specifications as specified in the general provisions and in accordance with applicable laws, codes and regulations required by owner. Comply with the current provisions of the following codes and standards:
- B. Annual book of ASTM standards, ASTM C 33 - standard specification for concrete aggregates, vol. 04.02, american society for testing and materials, Conshohocken, Pennsylvania 1996.

- C. Safety and performance guidelines: comply with all safety and performance requirements and all applicable references as specified in the ASTM F2480 standard guide for in-ground skate parks.

1.6 SUBMITTALS:

- A. Manufacturer's data: current printed specifications with application and installation instruction for proprietary materials.
- B. Shop drawings: submit shop drawings of all pre-cast concrete skate elements showing detail sections and profile for all precast items. Details shall show all reinforcing and special hardware required for fastening (prior to casting).
- C. Specified models: equipment model numbers or catalog numbers are listed in the specifications to identify a standard of quality required for this project.
- D. Contractors seeking to use pre-cast concrete equipment must obtain the owner's pre-approval. Any product that is not pre-approved will not be considered.
- E. The owner must receive, at least ten (10) calendar-days prior to bid opening, all documents and other submittals required to establish equality of a proposed pre-cast concrete product. Any submissions for approval that do not allow for a 10 day review period will not be accepted.
- F. Owner shall approve, disapprove, or require additional information for each request. Any approved pre-cast concrete products shall be identified in an addendum.
- G. All contractors shall disclose all instances of any prior municipal or owner rejections of the same or a similar product for "As equal" status to specifications for this or a similar product. Failure to disclose a prior rejection is grounds for denial of any request to approve a pre-cast concrete product.
- H. Owner shall have absolute discretion to determine whether any pre-cast concrete product meets the specifications. Owner has the authority to accept or reject submissions for any reason including prior experience or knowledge of a specific product or firm.

1.7 QUALITY ASSURANCE:

- A. Regulatory requirements: comply with applicable laws, codes, and regulations required by authorities having jurisdiction over work.
- B. Owner expectation: the supply and install of pre-cast concrete skate elements is specialized and requires highly qualified firms with specific experience and know-how in the manufacturing and installation of pre-cast concrete skate elements.
- C. Pre cast experience: contractor shall submit with their bid proof of prior successful experience (completed prime contractor and sub-contractor qualification form) for either themselves or a subcontractor in manufacturing and installing monolithic pre-cast concrete skate elements for similar skate parks as specified as follows:
- D. Required installer experience:

1. The precast concrete installer to perform the installation work shall be factory trained / certified and have a minimum of five (5) years experience installing precast concrete skatepark equipment as specified for this project. Precast concrete installer must have completed ten (10) public pre-cast concrete skate park facilities with a minimum size of 7,500 square feet (concrete surface only) within the prior 5 years from the bid due-date. Qualifying parks must currently be in good operating condition as determined by the owner. Qualifying parks must have at least 90% of the precast skate elements be monolithic, non-approach plate, pre-cast concrete skate elements that do not require site installed enclosures, metal support legs, or hardware.
2. Any installer who does not meet the minimum experience criteria as set forth above and reflected in the "Prime contractor and sub-contractor qualification form" will not be considered for this project.

E. Required manufacturer experience:

1. Manufacturer of all precast concrete elements must maintain the capacity and facilities to produce the quantity and quality of goods specified without any delay to the progress of the work. A "Qualifying facility" must have been in operation and producing pre-cast concrete skate elements at that same location for five (5) years. A "Qualifying facility" must have been in continuous operation producing pre-cast concrete products at the same location for the same length as the specified warranty period (five years).
2. Manufacturer to have completed at least fifteen (15) skateparks, that are a minimum of 7,500 sf (concrete surface only, landscaping does not count), constructed with the exact same materials and construction techniques. Upon request, manufacturer to provide list of completed structures to owners representative with skatepark owner's name, address, phone and representative's name. Qualifying parks must have at least 90% of the precast skate elements be monolithic, non-approach plate, pre-cast concrete skate elements that do not require site installed enclosures, metal support legs, or hardware. All projects used as references must currently be in good operating condition as determined by the owner.
3. Any manufacturer who does not meet the minimum experience criteria as set forth above and reflected in the "Prime contractor and sub-contractor qualification form" will not be considered for this project.

1.8 SITE CONDITIONS:

- A. Coordinate schedules of concrete placement to allow adequate time for installation of other related work.
- B. Coordinate earthwork and soils report requirements with placement requirements.
- C. Coordinate with form-work and finishes sections to provide finish floor levelness and flatness as specified herein. Slope to drains at grades and percent slope shown on contract documents.
- D. Ensure that irrigation sleeves, electrical conduit, drainage lines and other utility elements are accommodated and as-built located prior to placing concrete.

1.9 WARRANTY:

- A. General description: in addition to manufacturer's warranties, warrant work for a period of one year from the date of final completion against defects in materials and workmanship.
- B. Additional items covered: warranty shall also cover repair of damage to other materials and workmanship resulting from defects in materials and workmanship.
- C. Exceptions: contractor shall not be held responsible for failures due to ordinary wear, neglect by owner, vandalism, or other causes beyond the contractor's control.
- D. Manufacturer's warranty: bidder must submit a copy of the pre-cast skate element manufacturer's warranty. At a minimum, the warranty must provide 5 years of warranty coverage.

1.10 PRE-CAST CONCRETE SKATE PARK EQUIPMENT (GENERAL REQUIREMENTS):

- A. All numbered precast concrete components in the bid (as shown in the drawings) must be shipped and arrive on-site as fully integrated or "Monolithic" pieces requiring no further assembly.
- B. All skate park components shall be manufactured from high quality pre-cast concrete.
- C. Finished pre-cast concrete shall be free from defects in workmanship, and be of the highest quality.
- D. Poured on site elements or elements formed using shotcrete will not be acceptable for features specified as precast.
- E. Precast concrete components shall be reinforced with steel rebar and fiber reinforcement and meet the specifications listed below.
- F. All coping and edge protection shall be hot-dip galvanized or powder coated steel.
- G. All precast equipment must be self-retaining and have factory integrated sides and backs without the use of hardware or metal support legs.
- H. Precast equipment requiring site installation of retaining walls will not be accepted.

PART 2 – PRODUCTS

2.1 PRE-CAST CONCRETE SKATE ELEMENTS MATERIAL SPECIFICATIONS:

- A. Concrete:
 - 1. Type ii/il portland cement
 - 2. Max. ¾" rock aggregate (foam pellets are not acceptable)
 - 3. Mechanically vibrated in precise concrete mold (self-settling concrete is not acceptable)
 - 4. Cured in temperature controlled environment

5. Min. 4000 psi compressive strength @ 28 days

B. Reinforcement:

1. Reinforcing steel shall be new billet deformed bars and shall conform to astm standard a615.
2. Minimum cover for all reinforcing shall be 1 ½ ".
3. No. 3 rebar steel reinforcing @ 12" O.C. Grid steel reinforcing
4. Fiber reinforcement

C. Finish

1. All pre-cast elements must transition to the slab without the use of transition plates
2. Riding surfaces to be hand-finished smooth

D. Joints:

1. Hand finished with cementitious grout or caulk as needed.

E. Steel components:

1. Coping: 2 3/8" schedule 40, ASTM A 53 steel pipe shall be anchored to concrete ramp at 12" on center with steel studs, fitted with welded end caps and then ground smooth. Vent adequately for galvanizing finish. ASTM A 123 hot-dip galvanizing to occur after all welding is complete. Where field welds are necessary, use a high zinc dust content paint for re-galvanizing welds in galvanized steel. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
2. Angle edge protection: 1.5" x 2" x 3/16" thick, ASTM A36 steel angle shall be anchored at 12" on center. ASTM A123 hot-dip galvanizing finish to occur after all welding is complete. Where field welds are necessary, use a high zinc dust content paint for re-galvanizing welds in galvanized steel. The amount of edge protection can be customized to specifications. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
3. Channel edge protection: 2" x 4" x 2.5" x 1/8" thick ASTM A36 folded steel plate shall be anchored into the concrete ramp at 12" on center. ASTM A123 hot-dip galvanizing finish to occur after all welding is complete. Where field welds are necessary, use a high zinc dust content paint for re-galvanizing welds in galvanized steel. The amount of edge protection can be customized to specifications. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
4. Folded edge protection: 2" x 6" x 1/8" thick ASTM A36 folded steel plate shall be anchored into the concrete ramp at 12" on center. Hot-dip galvanizing to occur after all welding is complete. Where field welds are necessary, use a high zinc dust content paint for re-galvanizing welds in galvanized steel. The amount of edge protection can be customized to specifications. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.

5. Coping with grind plate/ coping with bmx plate (when applicable): 2 3/8" schedule 40, ASTM A 53 steel pipe shall be anchored into the concrete ramp at 12" on center using steel studs and welded to 4" x 3/16" ASTM A36 steel plate with anchors. Coping to be fitted with welded end caps and then ground smooth. Vent adequately for galvanizing finish. ASTM A123 hot-dip galvanizing to occur after all welding is complete. Where field welds are necessary, use a high zinc dust content paint for re-galvanizing welds in galvanized steel. This provides extra protection for bmx applications. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
6. Grind rail-rectangular: 3" x 2" x 1/8" thick ASTM A500 steel tube. All grind rails shall be fitted with welded end caps and then ground smooth. Vertical supports are 2" x 2" x 1/8" or 2" x 3" x 1/8" ASTM A500 steel tubing welded to the horizontal rail. All welds to be all around. Grind welds smooth before galvanizing finish. Vent adequately for galvanizing. ASTM A123 hot-dip galvanizing to occur after all welding is complete. These are cast or surface mounted into the concrete foundation during installation as specified in the construction drawings. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
7. Grind rail-round: 2 3/8" schedule 40, ASTM A 53 steel pipe. All grind rails shall be fitted with welded end caps and then ground smooth. Vertical supports are 2 3/8" schedule 40 ASTM A 53 steel pipe welded to the horizontal rail. All welds to be all around. Grind welds smooth before galvanizing finish. Vent adequately for galvanizing. ASTM A123 hot-dip galvanizing to occur after all welding is complete. These are cast or surface mounted into the concrete foundation during installation as specified in the construction drawings. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.
8. Guard rails (when applicable): 2" diameter ASTM A500 steel tube w/ ASTM A123 hot-dip galvanized corrosion resistant finish. Guard rail frame formed and rounded at corners with 1" diameter tube vertical pickets evenly spaced at no more than 4" on center. All guard rails shall be cast or surface mounted into the concrete foundation. Guard rails shall be a minimum of 42" high and shall prevent passage of a sphere equal to or greater than 4" outside diameter. Safety rails are constructed in a manner that does not allow a skateboard underneath and through the opening between the bottom of the rail and the resting deck. Powder coating steel surfaces is an acceptable alternative to hot-dip galvanizing.

2.2 INSPECTION:

- A. Inspect subgrade, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, and other work required to be built into concrete and report any discrepancies. Notify owner's representative at least 5 working days in advance of scheduled placement.
- B. Correct unsatisfactory work prior to placing abutting concrete.
- C. Remove rubbish from formwork immediately prior to placing concrete.

2.3 REPAIRS AND PROTECTION:

- A. Remove and replace pre-cast elements that are broken, damaged, defective, or do not meet the requirements of this section or conformance with ASTM F2480 - standard guide for in-ground skate parks.

- B. Protect pre-cast skate elements from damage until final payment. Exclude traffic from pre-cast skate elements for at least 7 days after placement.

2.4 OTHER:

- A. Safety and performance guidelines: comply with all safety and performance requirements and all applicable references as specified in the ASTM F2480 standard guide for in-ground skate parks.

2.5 SUBSTITUTIONS:

- A. Any product that does not meet the experience criteria as established on the qualification form will not be considered.
- B. Skatepark designer shall approve, disapprove, or require additional information for each request. Any approved substitutes shall be identified in an addendum.
- C. Any alternate products being submitted for equivalency shall disclose all instances of any prior municipal or landscape architect's rejection of the same or similar product for "as equal" status to the product specified for this project. Failure to disclose a prior rejection is grounds for denial of any request to approve an alternate product.
- D. Skatepark designer shall have absolute discretion to determine whether any submitted product is an equal. The landscape architect has the authority to accept or reject submissions for any reason including prior experience or knowledge of a specific product or firm.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING:

- A. Coordinate with work of cast-in-place concrete and shotcrete sections.
- B. Pre-cast concrete skate park components are to be stored at manufacturers facility, above ground on skids or other supports, until site is ready for their installation.
- C. Pre-cast concrete skate park components can be placed after a 7 day minimum curing time of the pre-cast footings.
- D. Suitable skate park site access is required for delivery and placement of pre-cast concrete skate park components. Access must allow tractor-trailer(s) and 70-ton crane (typ.) to park directly adjacent to pre-cast footings, without obstruction, for delivery and placement of components.

3.2 INSTALLATION:

- A. Pre-cast concrete skate park components are to be installed in accordance with manufacturers installation instructions and work is to be performed by factory certified/trained installers.
- B. All joints created by the placement of concrete adjacent to precast concrete skate components is the responsibility of the party placing the abutting concrete.

END OF SECTION 03 40 00

SECTION 03 50 00 - CAST-IN-PLACE CONCRETE

1.0 GENERAL

1.1 SCOPE

- a. This section gives requirements for normal weight structural concrete.
- b. Coordinate the requirements of this section with all other sections of Division 3, Concrete. All requirements of this section apply to those except as may be otherwise specified in such sections.

1.2 REFERENCE STANDARD

The current issue of ACI-301, "Specifications for Structural Concrete for Buildings" is a part of this specification and is applicable to this project.

1.3 SUBMITTALS

- a. Mill Certificates. Required for all bulk cement and reinforcing steel.
- b. Admixtures. Submit brochures on admixtures proposed for use if different from those specified.
 - (1) A submittal is required from the manufacturer of the approved airetraining admixture. Give requirements to control percent of air content under all conditions including temperature variations. Provide three (3) copies.
 - (2) A submittal is required from the manufacturer of the approved waterreducing retarder. Give requirements for quantities and types to be used under various temperatures and job conditions to produce a uniform, workable concrete mix.
- c. Design Mixes. Submit test data on proposed design mixes for each type of concrete in the project.
- d. Curing Method. Submit the proposed curing method for all concrete. If the use of a white pigmented membrane-forming compound is recommended, submit evidence that the compound is satisfactory for the intended application. A written guarantee will be required.

1.4 STORAGE OF MATERIALS

- a. Cement. Store cement in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.
- b. Aggregate. Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding three-feet (3') in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregates.

- c. Sand. Before using, allow sand to drain until a uniform moisture content is reached.
- d. Admixtures. Store admixtures to avoid contamination, evaporation or damage. For those used in the form of suspensions or nonstable solutions, provide suitable agitating equipment to assure uniform distribution of ingredients. Protect liquid admixtures from freezing and other temperature changes which would adversely affect their characteristics.

1.5 TESTING LABORATORY SERVICES

The tests required in this section will be performed by a commercial testing laboratory as specified in Division 1, General Requirements.

2.0 PRODUCTS

2.1 MATERIALS

- a. Portland Cement. Use cement conforming to ASTM C-150, Type "I." Type III may be used when specifically authorized. Use the same brand of cement upon which the selection of concrete was based. Only one (1) brand of each type will be permitted in any one structure, unless otherwise specified.
- b. Admixtures. Use the following admixtures as required or permitted. The use of calcium chloride will not be permitted. The products must conform to the referenced standards.
 - (1) Air-entraining Admixtures. Conform to ASTM C-260, such as Sika's "AER," Sonneborn's "Aerolith" or approved equal.
 - (2) Chemical Admixtures. Conform to ASTM C-494, "Tentative Specifications for Chemical Admixtures for Concrete."
 - (3) Water-reducing Retarder. Use of an admixture containing chloride is not permitted. The product must be nonstaining. Use Master Builder's "MBHC," Sika's "Plastiment" or approved equal.
- c. Mixing Water. Fresh, clean and drinkable.
- d. Aggregates. Use coarse aggregate from only one (1) source and fine aggregate from only one (1) source for exposed concrete in a single structure.
 - (1) Coarse aggregate for normal weight concrete shall conform to ASTM C-33. Grading limits for precast, prestressed members and for all members six- inches (6") or less in least dimension, one-inch (1") to No. 4. Grading for all other normal weight concrete, 1½-inches (1½") to No. 4.
 - (2) Use natural sand complying with ASTM C-33 for fine aggregate in normal weight concrete.

- e. Membrane-forming Curing Compound. ASTM C-309, white pigmented commercial curing compound which will not permanently discolor concrete.
- f. Sheet Material for Curing Concrete. ASTM C-171, waterproof paper, polyethylene film or white burlap-polyethylene sheeting.
- g. Non-shrink Grout. Master Builders' "Embeco 153," or approved equal, consisting of specially prepared catalyzed metallic aggregate, Portland cement that is not air-entrained, and specially size-graded sand.
- h. Reinforcing Steel. Use ASTM A-615, Grade 40 reinforcing steel. Use deformed bars except where smooth bars are specified.
- i. Expansion Joints. Use ASTM D-994 expansion joint filler, $\frac{3}{4}$ -inches ($\frac{3}{4}$ ") thick, unless otherwise show, from full depth to one-inch (1") above the slab. Use ASTM-1190 joint sealer to fill the joint. Provide joint filler and sealer at locations shown.

2.2 PROPORTIONING

- a. Objective. Select proportion of ingredients to produce concrete having proper placability, durability, strength, appearance, and other required properties. Proportion ingredients to produce a homogeneous mixture which will work readily into corners and angles of forms and around reinforcement by methods of placing and consolidation employed on the work, but without permitting materials to segregate or allowing excessive free water to collect on the surface.
- b. Strength. Provide ultimate strength concrete in all portions of the work. Strength must conform to values for the class of concrete specified for each portion of the structure. Requirements are based on 28-day compressive strength. If high early-strength concrete is specified, requirements are based on seven (7) day compressive strength.
- c. Entrained Air. Air-entrain all concrete, unless otherwise specified. Provide for not less than three-percent (3%) nor more than five-percent (5%) by volume of total entrapped and entrained air for normal weight concrete.
- d. Slump. The maximum permissible slump for concrete is four-inches (4"); the minimum is two-inches (2"). Determine slump by methods given in ASTM C-143.
- e. Admixtures. Proportion admixtures according to the manufacturer's recommendations. Use of an approved accelerator is permitted when the air temperature is less than 40°F. Use of an approved retarder is required when the temperature of placed concrete exceeds 85°F.

f. Classification and Use.

(1) Classification:

<u>Class</u>	<u>Minimum 28-Day Compressive Strength (psi)</u>	<u>Minimum Cement Contents Sacks per Cubic Yard*</u>
Normal Weight A	3000	5
Sidewalks B	2500	4½
Structural C	4000	6

* If the required strength is not secured with the minimum cement content as specified, add cement or provide other aggregates as necessary.

(2) Use the specified classes of concrete in the following locations:

(a) Class A – Slope Paving, Overflow Weir Structure, Culverts, and Wing Walls.

g. Water-Cement Ratio for Normal Weight Concrete. If the relationship between strength and the water-cement ratio has been determined previously for materials specified for normal weight concrete, the ratio may be used. Otherwise, determine the proper water-cement ratio by using the following procedures.

- (1) Make concrete trial mixtures having suitable proportions and consistency. Use at least three (3) different water-cement ratios which will produce a range of strengths encompassing those required. Design trial mixes to produce the maximum allowable slump.
- (2) Determine proportions of ingredients and conduct tests in accordance with basic relationships and procedures outlined in ACI 613, "Recommended Practice for Selecting Proportions for Concrete."
- (3) Make and cure specimens according to ASTM C-192, "Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory." For each water-cement ratio, prepare at least three (3) specimens for each age test. Test for strength at seven (7) days and 28 days, or other age as required. Conduct tests according to ASTM C39, "Method of Test for Compressive Strength of Molded Concrete Cylinders."
- (4) From results of these tests plot a curve showing the relationship between water-cement ratio and compressive strength.

- h. Alternate Determination of Proportions. In lieu of proportioning as specified for normal and light-weight concrete, a mix design employing the same ingredients proposed for use, and used successfully on previous projects under similar conditions may be used. To obtain the necessary approval, submit the following:

- (1) Concrete mix design.
- (2) Reports for at least 20 consecutive sets of 7-day and 28-day concrete strength tests made during the last six (6) months.
- (3) Reports of compliance tests of fine and coarse aggregates made during last six (6) months.

2.3 MIXING NORMAL WEIGHT CONCRETE

- a. Ready-Mixed Concrete. Mix and transport ready-mixed concrete according to ASTM C-94, "Specifications for Ready-Mixed Concrete." In addition, the batch plant shall provide for the following items:
- (1) Arrangement. Provide separate bins or compartments for different sized aggregates and for bulk cement. Compartments of ample size constructed so that materials will be kept separate under all working conditions are required.
 - (2) Weighing of Materials. Aggregates may be weighed in separate weigh batchers with individual scales. Weigh bulk cement on a separate scale in a separate weigh batcher. Observe the following limits of accuracy when weighing or measuring materials.

<u>Materials</u>	<u>Percent Accuracy</u>
Cement	1
Water	1
Aggregates	2
Admixture	3

- (3) Water Meter or Batchers. Provide a suitable measuring device capable of measuring mixing water within the specified accuracy for each batch. Note the number of gallons of water as batched on printed batching tickets.
- (4) Moisture Control. Provide a moisture meter to measure the amount of free water in fine aggregates within 0.3 of a percent. Compensate for varying moisture contents of fine aggregates and change batch weights of materials if necessary before batching.
- (5) Scales. Provide adequate facilities for accurate measurement and control of each material entering each batch of concrete. Accuracy of weighing equipment must conform to applicable requirements of ASTM and NRMCA for such equipment.

- (6) Recorders or Printers. Provide recorders/printers to produce tickets. Each ticket will provide a printed record of weights for cement as batched and for separate aggregates as batched individually. Use the type of indicator that returns for zero punch or to zero after a batch is discharged. Clearly indicate by stamped letters or numbers the difference between aggregates and cement as batched. Show the time of day stamped or printed at intervals of not more than six (6) minutes. Deliver recorded ticket copies with concrete. The testing agency will keep one (1) copy.
- (7) Protection. Protect weighing, indicating, recording or printing, and control equipment against exposure to dust and weather.

b. Transit Mix Truck Requirements.

- (1) Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant.
- (2) Keep the water tank valve on each transit truck locked at all times that the truck is in use. Any addition of water must be directed by the Engineer. Added water must be incorporated by additional mixing of at least 35 revolutions or two (2) minutes.
- (3) Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

c. Batch Mixing at Site.

- (1) Mix concrete in a batch mixer conforming to requirements of the Mixer Manufacturers' Bureau of the Associated General Contractors of America. Use a mixer equipped with a suitable charging hopper, water storage tank and water measuring devices. It must be capable of thoroughly mixing aggregates, cement and water into a uniform mass within the specified mixing time, and of discharging the mix without segregation. Operate the mixer according to the rated capacity and recommended revolutions per minute printed on the manufacturer's rating plate.
- (2) Charge the batch into the mixer so that some water will enter in advance of cement and aggregates. Keep water running until $\frac{1}{4}$ of specified mixing time has elapsed. Provide controls to prevent discharging until the required mixing time has elapsed. When concrete of normal weight is specified, provide controls to prevent the addition of water during mixing. Discharge the entire batch before the mixer is recharged.
- (3) Mix each batch of two (2) cubic yards or less for not less than one (1) minute and 30 seconds. Increase mixing time 15 seconds for each additional cubic yard or fraction of a yard.
- (4) Keep the mixer clean. Replace pick-up and throw-over blades in the drum when they have lost 10 percent (10%) of original depth.

d. Admixtures.

- (1) Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device. Measure admixture to an accuracy within ± 3 percent (3%). Do not use admixtures in powdered form.
- (2) Two (2) or more admixtures may be used in the same concrete, provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other. Inject the admixtures separately during the batching sequence.
- (3) Add retarding admixtures as soon as practicable after the addition of cement.

e. Temperature Control.

- (1) When the mean temperature falls below 40°F, keep the admixed temperature above 55°F to maintain concrete above the minimum placing temperature.
- (2) If water or aggregates have been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to the mixtures of water and aggregate when the temperature of the mixture is greater than 95°F.
- (3) In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature. If necessary, substitute well-crushed ice for all or part of the mixing water.

3.0 EXECUTION

3.1 PREPARATION

- a. Coordination. Mix concrete only in quantities for immediate use. Discard concrete which has set. Retempering of set concrete is not permitted. Completely discharge concrete at the site within one (1) hour and 30 minutes after adding cement to aggregate. In hot weather reduce this time to one (1) hour or less to prevent stiffening of concrete before it is placed.
- b. Protection from Adverse Weather. Unless adequate protection is provided or approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase mixing water or to damage the surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect the work.
- c. Placing Temperature.
 - (1) Cold Weather. Unless special provisions are made for heating the concrete mix and concrete in forms, do not place any concrete when the air temperature is below 40°F or is predicted to be below 40°F within the next 48 hours after placement. Provide and use protective material and heating equipment as required to maintain the temperature of the concrete surface at not less than 35°F for a period of at least 36 hours after placement.
 - (2) Hot Weather. When the air temperature is above 85°F, use of an approved retarding agent is required in all concrete. Concrete temperature prior to placement shall not exceed 95°F.

- d. Adjusting Slump. If concrete arrives at the project with slump below that specified, water may be added. Indiscriminate addition of water to increase slump is prohibited. Do not exceed either the maximum permissible water-cement ratio or maximum slump. Any addition of water above the maximum water-cement ratio must be accompanied by a corresponding quantity of cement. Mix adjustments to obtain specified slump must be approved and directed by the Engineer.

3.2 CONVEYING

- a. Objectives. Handle concrete from mixer to placement as quickly as practicable while providing concrete to required quality in the placement area. Use methods which prevent loss of ingredients and segregation.
- b. Equipment. Obtain approval of the conveying equipment. Select equipment of size and design to insure continuous flow of concrete at the delivery end. Conform to the following equipment and operations requirements.

- (1) Provide truck mixers, agitators, nonagitating units and manner of operation conforming to requirements of ASTM C-94, "Specifications for Ready-Mixed Concrete."
- (2) Use belt conveyors configured horizontally or at a slope which causes no segregation or loss. Use an approved arrangement at the discharge end to prevent separation. Discharge long runs without separation into a hopper.
- (3) Provide metal or metal-lined chutes. Arrange for slopes not exceeding one (1) vertical to two (2) horizontal and not less than one (1) vertical to three (3) horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- (4) Pumping of concrete will be permitted only after written approval. Use a batch design and aggregate sizes suitable for pumping.

- c. Maximum Time to Placement

The maximum time interval between the addition of cement to the batch, and the placing of concrete in the forms shall not exceed the following:

Air or Concrete Temperature (Whichever is Higher)	Maximum Time (Addition of Water or Cement to Placing in Forms)
Non-Agitated Concrete	
Over 80°F	15 Minutes
35°F to 79°F	30 Minutes
Agitated Concrete	

90°F or Above	45 Minutes
75°F to 89°F	60 minutes
35°F to 74°F	90 Minutes

The use of an approved retarding agent in the concrete will permit the extension of each of the above temperature-time maximums by 30 minutes for bridge decks, top slabs of direct traffic culverts and cased drilled shafts, and one hour for all other concrete except that the maximum time shall not exceed 30 minutes for non-agitated concrete.

3.3 PLACING

- a. Preparation. In addition to the previous requirements, confirm that formwork has been completed. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement is securely in place and expansion joint material, anchors and other embedded items are properly positioned. Have a competent workman at the pour location who can assure that reinforcement and embedded items remain in design locations while concrete is being placed. Sprinkle semiporous subgrades to eliminate suction. Seal extremely porous subgrades in an approved manner.
- b. Procedure.
 - (1) Deposit concrete continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
 - (2) Proceed with placement at a rate such that concrete which is being integrated with fresh concrete is still plastic. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
 - (3) Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only if made of galvanized metal or concrete, and if prior approval has been obtained.
 - (4) Do not start placing of concrete in supported elements until concrete previously placed in columns and walls is no longer plastic.
 - (5) Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to a procedure which will cause segregation.
 - (6) Where surface mortar is to be the basis of a finish, especially those designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of mortar against the form. Prevent formation of excessive surface voids.

- (7) Consolidate concrete by vibration, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms. Eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness. A minimum frequency of 7000 revolutions per minute is required for mechanical vibrators. Do not use vibrators to transport concrete within forms. Insert vibrators and withdraw at points from 18 to 30 inches apart. At each insertion vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over-vibrate causing segregation. Keep a spare vibrator on the site during concrete placing operations.
- c. Concreting Under Water. When required or permitted, deposit concrete under water by an approved method. Obtain advanced approval of the method from the Engineer. Deposit concrete in such a way that fresh concrete enters the mass of previously placed concrete from within, causing water to be displaced with a minimum disturbance at the surface of the concrete.

3.4 REPAIRING SURFACE DEFECTS

- a. Defective Areas. Repair defective areas immediately after the removal of forms.
 - (1) Remove honeycombed and other defective concrete down to sound concrete. To prevent absorption of water from patching mortar, dampen the defective area and a strip six-inches (6") wide surrounding the area to be patched. Prepare bonding grout by mixing approximately one (1) part cement to one (1) part fine sand passing a No. 30 mesh sieve. Mix to a consistency of thick cream, and brush thoroughly into the surface.
 - (2) Make patching mortar of the same materials and of approximately the same proportions as concrete, except omit coarse aggregate. Prepare mortar with not more than one (1) part cement to 2½ parts sand by damp loose volume. Substitute white Portland cement for part of the gray Portland cement on exposed concrete in order to produce a color matching the color of surrounding concrete. Determine color by making a trial patch.
 - (3) Use no more mixing water than necessary for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with a trowel until it has reached the stiffest consistency that will permit placing. Do not add water.
 - (4) After surface water has evaporated from the area to be patched, thoroughly brush a coat of bond grout into surface. When bond grout begins to lose its water sheen, apply the premixed patching mortar. Thoroughly consolidate the mortar into place and strike off to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave undisturbed for at least one (1) hour before final finishing. Keep the patched area damp for seven (7) days. Do not use metal tools in finishing patches in a formed wall which will be exposed.
- b. Tie Holes. Patch tie holes immediately after removal of forms. After cleaning and thoroughly dampening the tie hole, fill solid with patching mortar.
- c. Proprietary Materials. If permitted or required, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Use such compounds according to the manufacturer's recommendations.

3.5 FINISHING OF FORMED SURFACES

- a. Surfaces Requiring No Finish. A finish is not required on surfaces concealed from view by earth, water, ceiling, etc. in the completed structure.
- b. Smooth Form Finish.
 - (1) Use plywood or fiberboard linings or forms in as large sheets as practicable and with smooth, even edges and close joints.
 - (2) Patch tie holes and defects. Rub fins and joint marks with wooden blocks to leave a smooth, unmarred finished surface.
 - (3) Use a smooth form finish on faces of exposed concrete.

3.6 FINISHING SLABS AND SIMILAR FLAT SURFACES

- a. Shaping to Contour. Use strike-off templates or approved compacting-type screeds riding on screed strips and edge forms to bring concrete surface to the proper contour. See the section on Concrete Formwork for edge forms and screeds.
- b. Consolidation. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Obtain consolidation of slabs and floors with vibrating bridge screeds, roller pipe screeds, or other approved means. Concrete to be consolidated must be as dry as practicable. Do not permit manipulation of surfaces prior to finishing operations.
- c. Tolerances for Finished Surfaces. Tolerances are checked by placing a straightedge of specified length anywhere on the slab. The gap between slab and straightedge must not exceed the tolerance listed for the specified class.

<u>Class</u>	<u>Straightedge Length</u> <u>In Feet</u>	<u>Tolerance</u> <u>In Inches</u>
A	10	—
B	10	$\frac{1}{4}$
C	10	$\frac{1}{8}$

- d. Floated Finish.
 - (1) After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when the mix has stiffened sufficiently to permit proper operation of a power-driven float. Consolidate the surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to a power-driven machine and on small, isolated slabs.

- (2) Recheck tolerance of the surface after initial floating with a 10-foot (10') straightedge applied at not less than two (2) different angles. Cut down high spots and fill low spots to Class "B" tolerance. Immediately refloat slab to uniform, smooth, granular texture.

e. Troweled Finish.

- (1) To obtain a troweled finish, a floated finish as previously specified must be applied. After power floating, use a power trowel to produce a smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after the surface has hardened sufficiently. Do final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by hand troweling operations.
- (2) Produce a finished surface free of trowel marks, uniform in texture and appearance and conforming to Class "A" tolerance. On surfaces intended to support floor coverings, remove defects which might show through covering by grinding.

3.7 CURING PROCEDURES

- a. Objective. Protect freshly deposited concrete from premature drying and excessively hot or cold temperatures. Maintain a minimal moisture loss and a relatively constant temperature during the time necessary for hydration of cement and proper hardening of concrete.
- b. Initial Curing. Immediately after the finishing operation, begin initial curing. Keep concrete continuously moist at least overnight. Use one of the following materials and methods for initial curing:
 - (1) Ponding or continuous sprinkling.
 - (2) Absorptive mat or fabric kept continuously wet.
 - (3) Sand or other covering kept continuously wet.
 - (4) Continuous steam bath (not exceeding 150 F at the surface of concrete).
 - (5) Vapor mist bath.
 - (6) Membrane-forming curing compound applied according to the manufacturer's recommendations.
- c. Final Curing. Immediately following the initial curing and before concrete has dried, provide additional curing by one (1) of following materials or methods:
 - (1) Continuing the method used in initial curing.
 - (2) Waterproof paper, polyethylene film or white burlap-polyethylene sheeting.

- (3) Other moisture-retaining coverings as approved.
- d. Duration of Curing. Continue final curing until the cumulative number of days or fractions of days during which the ambient temperature is above 50°F has totaled seven (7). If high-early-strength concrete has been used, combine final curing for a total of three (3) days. Prevent rapid drying at the end of the curing period.
- e. Curing Day. A curing day is defined as a calendar day when the temperature, taken in the shade away from artificial heat, is above 50°F for at least 19 hours, (or colder days if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 40° F for the entire 24 hours). The required curing period shall begin when all concrete has attained its initial set.
- f. Formed Surfaces. Steel forms heated by the sun and wood forms in contact with concrete during final curing period shall be kept wet. If forms are to be removed during the curing period, employ one (1) of the above curing materials or methods immediately. Continue such curing for the remainder of the curing period.
- g. Temperature.
- (1) Cold Weather. Place concrete only when the temperature is above 40°F and rising. Place no concrete if the temperature is below 50°F and falling. Maintain the ambient temperature of the air surrounding the concrete above 50°F for the required curing period. When necessary, make arrangements for heating, covering, insulating or housing concrete work in advance of placement to maintain the required temperature and moisture conditions. Prevent injury due to concentration of heat.
- (2) Hot Weather. When necessary, make arrangements for installation of windbreaks, shading, fog spraying, sprinkling, ponding or wet covering of light color in advance of placement. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
- (3) Temperature Changes. Control changes in temperature of concrete at a rate as uniform as possible. Do not permit a temperature change to exceed 5°F in any one hour or 50°F in any 24-hour period.
- h. Protection From Mechanical Injury. During the curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials, or methods and by rain or running water. Do not load self-supporting structures in any way that overstresses concrete.

END OF SECTION 033000

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete Masonry Units
- B. Epoxy Bonding Adhesive
- C. Control Joint Materials
- D. Joint Reinforcement
- E. Reinforcing Steel
- F. Mortar
- G. Grout
- H. Surface Sealer

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for concrete unit masonry will be either by the lumpsum method or by the unit-price method as determined by the listing of the bid item for concrete unit masonry indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for concrete unit masonry, the lumpsum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for concrete unit masonry, the unitprice method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Concrete unit masonry will be measured by the square foot or square yard for each type of masonry unit and thickness of wall. No deductions will be made for openings less than 64 inches square.
 - b. Vertical and horizontal steel reinforcement, control joints, mortar, grout, anchors, ties, masonry cleaning, sealer, and miscellaneous accessories will not be measured separately for payment; such items will be considered incidental to, and included with, the concrete unit masonry work.

2. Payment: Concrete unit masonry will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.03 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 530 Building Code Requirements for Masonry Structures
2. ACI 530.1 Specifications for Masonry Structures

B. American Society for Testing and Materials (ASTM):

1. ASTM C33 Specification for Concrete Aggregates
2. ASTM C90 Specification for Hollow Load-Bearing Concrete Masonry Units
3. ASTM C91 Specification for Masonry Cement
4. ASTM C94 Specification for Ready-Mixed Concrete
5. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
6. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
7. ASTM C144 Specification for Aggregate for Masonry Mortar
8. ASTM C150 Specification for Portland Cement
9. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
10. ASTM C270 Specification for Mortar for Unit Masonry
11. ASTM C404 Specification for Aggregates for Masonry Grout
12. ASTM C476 Specification for Grout Masonry
13. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
14. ASTM C979 Specification for Pigments for Integrally Colored Concrete
15. ASTM C1006 Test Method for Splitting Tensile Strength of Masonry Units
16. ASTM C1019 Test Method for Sampling and Testing Grout

1.04 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 21, "Masonry," and Chapter 21A, "Masonry."

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: When not indicated in sufficient detail or definition, submit detailed drawings of unit masonry, showing type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints.
- C. Product Data: Submit manufacturer's product data for block, including available color range, epoxy adhesive, joint reinforcement, and control-joint materials, along with installation instructions where applicable.
- D. Samples: Submit full-size sample of block and samples of colored mortar for approval. Block and colored joint mortar require approval of the Engineer before they may be used in the concrete masonry work.
- E. Certificates: Submit certification stating that concrete masonry units meet specification requirements and that masonry units conform with the special strength requirements of these Specifications. Each certificate shall be signed by the masonry unit manufacturer and shall contain the name of the manufacturer, the project location, and the quantity and dates of shipment or delivery to which the certificate applies.

1.07 QUALITY ASSURANCE

- A. Concrete unit masonry work shall conform with applicable requirements of the California Building Code, Chapters 21 and 21A, ACI 530, and ACI 530.1, except as modified in these Specifications.
- B. Construction tolerances for concrete unit masonry shall conform with ACI 530.1.
- C. Refer to Section 01 45 00 - Quality Control, for additional requirements and procedures.

PART 2 - PRODUCTS 2.01 MATERIALS

- A. Concrete Masonry Units (Concrete Block):
- Concrete masonry units shall be of modular face dimensions and thicknesses indicated. Furnish necessary shapes and sizes, bond-beam units, and corner units as required to satisfy conditions indicated. Include half-size units where indicated or required.

2. Concrete masonry units shall be hollow load-bearing units conforming to ASTM C90, and shall be No. 1 Normal Weight, No. 2 Medium Weight, or No. 3 Light Weight, as applicable, Type I - Moisture Controlled Units. Units shall have a maximum linear shrinkage of 0.06 percent, and shall meet water absorption requirements of ASTM C90.
 3. Concrete masonry units shall be normal cement-colored units with standard face surfaces. Cinders or ingredients that might stain paint finishes will not be permitted in the manufacture of concrete masonry units.
- B. Cement: ASTM C150, Type I or Type II Portland cement, low alkali. Provide white cement when required to achieve the mortar color selected by the Engineer. ASTM C91, Type S, masonry cement may be used together with ASTM C150 portland cement as herein specified under "Mortar."
- C. Lime: ASTM C207, hydrated, Type S.
- D. Mortar Sand: ASTM C144, natural sand, clean and graded.
- E. Mortar Coloring Pigment: ASTM C979, manufactured, inert mineral oxides in color or colors as selected and approved by the Engineer.
- F. Grout Aggregate: ASTM C33 or ASTM C404, clean and graded concrete aggregates, proportioned by volume as follows: 3 parts fine and graded concrete aggregate to 2 parts of graded 3/8-inch maximum size coarse aggregate.
- G. Water: Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the hardening of cement mortar.
- H. Epoxy Bonding Adhesive: Adhesive for bonding of mortar bed to concrete slabs shall be an epoxy-based bonding agent conforming to ASTM C881, Type V, tinted to show by visual inspection where it has been applied.
- I. Control Joint Materials: Conform with requirements of ACI 530.1.
- J. Joint Reinforcement: No. 9 gage ladder or truss type steel wire conforming to ACI 530.1.
- K. Reinforcing Steel: Provide reinforcing steel for grouted block masonry under this Section in accordance with the requirements of Section 03 20 00 - Concrete Reinforcing, and ACI 530.1.

2.02 MORTAR

- A. Mortar Type and Mixing Requirements:
1. Mortar for grouted unit masonry shall be Type S mortar in accordance with the California Building Code, Chapter 21 and 21A, ACI 530.1, and ASTM C270, with a minimum compressive strength at 28 days of 1,500 psi. A minimum of two 94-pound sacks of portland cement (ASTM C150) shall be provided per cubic yard of mortar when using ASTM C91 masonry cement.
 2. The use of an admixture for the purpose of reducing water content in mortar will be permitted, provided the strength of the mortar is not reduced.

3. Mortar shall be job mixed and, in lieu of specific requirements specified herein, shall conform with ASTM C270, including measurement, mixing, proportioning, and water retention.
 4. Accurately measure mortar ingredients and mix a minimum of three minutes after water has been added, in a mechanical batch mixer, using sufficient water to produce a workable and plastic consistency. Hand mixing will be permitted for small quantities only.
 5. Use mortar within 2-1/2 hours after mixing when air temperature is 80 degrees or higher, and within 3-1/2 hours when air temperature is below 80 degrees. Discard any mortar that has been mixed longer or that has begun to set. If necessary, mortar may be retempered within this time limit, by replacing only water lost due to evaporation and by thorough remixing.
- B. Colored Joint Mortar: Provide colored mortar for exposed masonry joints where indicated. Color shall be as approved by the Engineer from samples prepared and submitted by the Contractor. Pigment amount for selected color and mixing of colored mortar shall conform with the pigment manufacturer's instructions.

2.03 GROUT

- A. Grout shall be Coarse Grout, as defined in ASTM C476, with a minimum compressive strength at 28 days of 2,000 psi, and shall be proportioned by volume in accordance with ACI 530.1.
- B. Grout mix shall be designed in accordance with ASTM C94 for manufacturer designed mixes, and for handling by an approved grout pump. Slump shall be 10 inches.
- C. The use of an admixture for the purpose of reducing water content in grout and adding flowability will be permitted, provided the strength of the grout is not reduced. Admixture shall be added to the mix as recommended by the manufacturer for the purpose intended.

2.04 SURFACE SEALER

- A. Provide a water-based, VOC-compliant, clear, penetrating water-repellent sealer, designed to provide long-term protection against water absorption, for exterior concrete unit masonry surfaces. Submit sealer performance data and VOC compliance verification for approval.

PART 3 - EXECUTION 3.01 LAYING CONCRETE MASONRY UNITS

- A. Installation Standards: Comply with applicable requirements of ACI 530.1.
- B. Requirements: Construct concrete unit masonry to dimensions indicated. Concrete masonry units shall be dry when laid. Avoid using less than half-size units in exposed locations. Do not expose cells on any surface. Where concealed, spaces not large enough for full or half-size units may be filled with concrete building brick or mortar.
- C. Work Quality:

1. Masonry work shall be performed by skilled and experienced masons. Erect walls plumb and true to line, with courses level and joints uniform in width, using specified mortar. Vertical joints shall line up plumb in exposed walls.
 2. Concrete masonry units shall be sound and free of cracks and surface defects. Handle units carefully to avoid chipping and breaking. Do not substitute cut units where special shapes are available.
 3. Where steel beams or joists frame into masonry, fill spaces with mortar and finish off flush with masonry surface, neatly pointed around steel. Where pipes and ducts penetrate masonry, point neatly and accurately around pipes and ducts.
- D. Cutting of Units: Cutting of units shall be kept to a minimum. Perform cutting accurately to accommodate items passing through or embedded in masonry, to meet surfaces that masonry abuts, and to fit various conditions. Cutting of masonry units shall be performed with a powerdriven masonry saw. Rub cuts smooth and even with carborundum or emery stone.
- E. Bedding and Jointing:
1. Use full mortar bed and coverage on horizontal and vertical face shells of hollow units. Webs also shall be bedded in mortar. Shove vertical joints tight.
 2. Top surfaces of concrete foundations or other bed joints shall be clean concrete with aggregate exposed before start of laying. Tops of foundations shall be roughened and cleaned to remove laitance for exposing aggregates in the concrete. Where block is to be laid on slabs, bed joints shall be roughened and cleaned, and an epoxy bonding adhesive shall be applied before laying first course of block.
- F. Joint Reinforcement: Provide ladder or truss type joint reinforcement, spaced a maximum of 16 inches on center vertically. Place in accordance with ACI 530.1, fully embedded in mortar.
- G. Bond Pattern: Lay masonry units in stretcher bond or running bond, unless otherwise indicated.
- H. Alignment of Vertical Cells: Masonry shall be built to preserve the unobstructed vertical continuity of the cells. The vertical alignment shall be sufficient to maintain a clear, unobstructed vertical flue, measuring not less than 3 inches in all directions for grouted masonry.
- I. Cleanouts: Cleanout openings shall be provided at the bottoms of cells to be filled with grout. Mortar droppings shall be removed from cells, and cleanouts shall be sealed after inspection and before grout placement.
- J. Pipe Chases: Chases and recesses for conduits, pipes, and ducts shall be formed as masonry work is constructed. Do not enclose conduit runs until complete and approved, or piping until it has been tested and approved. Make such chases and recesses plumb, with inside joints struck flush, and the interiors kept free of obstructions and cleaned-out upon completion.
- K. Anchorage and Embedded Items:
1. Set accurately in place and bond into masonry, as the masonry work progresses, bolts, straps, hangers, sleeves, anchors, inserts, frames for doors and windows, and any other anchorage items or attachments as indicated. Provide suitable recesses for cabinets, junction boxes,

panels, and other items to be built into masonry. Consult with other trades in advance so their work can be accommodated at correct locations, as masonry work progresses, to avoid cutting and patching.

2. Cells containing anchorage or built-in items shall be grouted solid.
3. Where masonry is laid against concrete or metal, the joints between shall be filled with mortar as each course is laid.

L. Joint Finishing:

1. Pack mortar tightly in joints and wipe wall faces clean as work progresses. Unless otherwise indicated, exposed joints shall be densely tooled concave and smooth with joint tool when mortar is thumbprint hard.
2. Joints in work concealed by other finishes shall be cut or struck off flush. Rake out joints around metal frames in openings 3/4-inch deep for sealant to be applied under Section 07 90 00 - Joint Protection.
3. Nominal joint size, both vertical and horizontal, shall be 3/8 inch.

M. Joining Work: Step back unfinished work for joining with new work. Toothing shall be resorted to only where unavoidable. Before starting or resuming work, remove loose mortar and foreign matter from work in place, and clean all surfaces of work to be joined.

N. Control Joints: Provide control joints where indicated. Comply with ACI 530.1.

O. Precast Beams, Lintels, and Copings: Provide precast concrete units where indicated. Comply with ACI 530.1, and applicable requirements of Section 03 40 00 - Precast Concrete.

3.02 REINFORCING STEEL

A. Provide reinforcing steel for grouted masonry as indicated. Comply with applicable requirements of ACI 530.1.

B. Vertical reinforcing bars shall be placed prior to laying the wall and shall be held in place by standard reinforcing supports. Vertical bars shall be held in position at top and bottom and at intervals not exceeding 190 diameters of the reinforcement or 9 feet, whichever is less. Vertical reinforcing steel shall have a minimum clearance of 1 inch from the masonry.

C. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowels shall be grouted into a core in vertical alignment, even though it is an adjacent cell to the vertical wall reinforcing.

D. Horizontal reinforcing bars for bond-beam or channel units shall be laid on the webs of the units in continuous masonry courses, and shall be solidly embedded in mortar and grout. Horizontal bars shall be tied to vertical bars as the block work progresses. Placing of horizontal reinforcing bars in mortar joints will not be permitted.

- E. Reinforcing bars shall be straight except for bends around corners and where bends or hooks are indicated.
- F. Reinforcing steel shall be lapped in accordance with ACI 530, Chapter 8. Length of lapped splices shall be not less than 30 bar diameters for bars in compression and 40 bar diameters for bars in tension. Lapped splice bars shall be wire-tied together for the entire length of the splice.

3.03 GROUTING

A. Grouting Requirements:

1. Cells of concrete unit masonry shall be filled solid with grout where indicated. Cells containing reinforcement and anchorage or built-in items shall be filled solid with grout. Comply with applicable requirements of ACI 530.1.
2. Spaces around metal frames and other built-in items shall be filled solid with grout or mortar.
3. Reinforcing steel shall be secured in place, inspected, and approved before grouting starts.
4. Mortar droppings and projections shall be kept out of the grout space. Webs, wythes, and reinforcement shall be cleaned of mortar droppings before grout is placed.
5. Grout shall be rodded, puddled, or vibrated in place.
6. Cells shall be filled solid with grout, and pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.
7. Grouting of beams over openings shall be performed in one continuous operation. Tops of unfilled cell columns under a horizontal masonry beam shall be covered with metal lath, or special units shall be used to confine the grout fill to the beam section.

B. Grout Construction:

1. Grout construction, including grout placement and consolidation, shall conform with applicable requirements of ACI 530.1, except as otherwise specified herein.
2. Grout shall be placed in lifts not to exceed 4 feet, with a waiting period of one hour between lifts. The full height of the wall or masonry section shall be placed in one day.
3. Rod or vibrate grout thoroughly the entire height of the pour when first placed to push grout into all spaces and interstices. After the waiting period of an hour, place second lift and rod or vibrate the pour again to penetrate not more than half way into the first lift. Repeat this placing operation, waiting period, and consolidating technique until the top is reached. The top pour or lift shall likewise be reconsolidated after waiting period to allow excess water to be absorbed and escape.

3.04 REPAIRING AND POINTING

- A. Upon completion of the work, carefully examine masonry surfaces and cut out and replace broken or defective units. Rake out defective mortar joints and repoint.

3.05 CLEANING

- A. After erection and pointing, masonry shall be cleaned down with stiff brushes and water, followed by a thorough rinsing with clean water. All mortar deposits, stains, or other foreign matter shall be removed from masonry surfaces.
- B. After masonry has been fully grouted, laitance and stains that have percolated through the blocks and mortar joints shall be hosed off with water under pressure.
- C. The Engineer may direct that certain masonry surfaces or areas be cleaned with a commercial masonry cleaner manufactured for the purpose, in which case follow the instructions or recommendations of the masonry-cleaner manufacturer for cleaning method.

3.06 CURING

- A. Masonry work and top of the grout pour shall be damp-cured for at least 7 days to prevent too rapid drying during hot or drying weather, and drying winds.
- B. Walls shall be kept moist or damp with water from a fogging nozzle, but shall not be wet to the point that free water drops from the surface.

3.07 SEALER APPLICATION

- A. Preparation: Surfaces receiving sealer shall be thoroughly dry and free of all construction stains, surface dirt, and efflorescence.
- B. Application: Apply sealer, where concrete unit masonry is exposed to the weather, in accordance with the manufacturer's application instructions and recommendations.

3.08 FIELD QUALITY CONTROL

- A. Slump Tests: Perform slump tests of grout during grout placement in accordance with ASTM C1019 and ASTM C143.
- B. Strength Tests: Provide laboratory tests conforming to the following requirements:
 - 1. Concrete Masonry Units: Tensile strength tests shall be performed in accordance with ASTM C1006. Three units shall be tested for each 2,000 square feet of wall area.
 - 2. Mortar: Compressive strength tests shall be performed in accordance with ASTM C109. Three cubes shall be tested for each 2,000 square feet of wall area, one at seven days and two at 28 days.
 - 3. Grout: Compressive strength tests shall be performed in accordance with ASTM C1019. Three square prisms shall be tested for each 2,000 square feet, or fraction thereof, of wall area.
- C. Test Reports: Submit certified copies of all test results to the Engineer for record purposes.

- D. Rejection of Masonry; Repair and Replacement: The Engineer shall have authority to reject concrete masonry work that does not meet specification requirements, and to require repair or replacement as necessary to complete the concrete masonry work.

3.09 ACCEPTANCE OF STRUCTURE

- A. Acceptance of the completed concrete masonry work requires conformance with the dimensional tolerances, appearance, and strengths specified in these Specifications and in ACI 530 and ACI 530.1.

END OF SECTION

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Field-installed shear connectors.
- B. Related Requirements:

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, and testing agency.
- B. Welding certificates.

- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
- F. Source quality-control reports.
- G. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes re-packaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Moment Connections: Type FR, fully restrained.
- B. Construction: Combined system of moment frame, braced frame, and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M, except ASTM A 572/A 572M, Grade 50 for shapes indicated as steel with $F_y = 50$ ksi .
- C. Plate and Bar: ASTM A 36/A 36M, except ASTM A 572/A 572M, Grade 50 for shapes indicated as steel with $F_y = 50$ ksi .
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 1. Weight Class: Standard, Extra strong, or Double-extra strong, as indicated.
 2. Finish: Black except where indicated to be galvanized. F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls, exterior locations, indoor pool area pool mechanical room.
 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls, exterior locations, indoor pool area pool mechanical room.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, coldfinished carbon steel; AWS D1.1/D1.1M, Type B.
- C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 1. Nuts: ASTM A 563 hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436, Type 1, hardened carbon steel.

4. Finish: Plain, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls, exterior locations, indoor pool area pool mechanical room. D. Threaded Rods: ASTM A 36/A 36M.
1. Nuts: ASTM A 563 hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls, exterior locations, indoor pool area pool mechanical room.

2.4 PRIMER

- A. Primer: SSPC-Paint 25 BCS, Type I, zinc oxide, alkyd, linseed oil primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 or ASTM A 780/A 780M.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes: Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." Hand-tool cleaning and power tool cleaning are not acceptable deviations.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- B. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested. C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling 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. Weld plate washers to top of baseplate.
 3. Snug-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.

4. 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.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. 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 is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.

3.5 INSTALLING LEVELING AND BEARING PLATES

- A. Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.

- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 powertool cleaning.

END OF SECTION 051200

SECTION 05 50 00 – METAL FABRICATION FOR SKATEPARKS

PART 1 - GENERAL

1.1 GENERAL INFORMATION

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the contract, including, but not limited to bowl steel coping, ledge steel edging, handrails, and grind rails.

1.2 REFERENCE STANDARDS

- A. All welding shall conform to requirements of AWS standards.
- B. ASTM a-36 for c, mc, angles, and plates.
- C. ASTM a-53 grade a or a-500 grade a or a-501 grade a for steel pipes.
- D. ASTM a-123 standard specification for zinc (hot-dip galvanized) coatings on iron and steel products
- E. ASTM a-780 standard practice for repair of damaged and uncoated areas of hot-dip galvanized coatings.

1.3 RELATED SECTIONS:

- A. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE FOR SKATEPARKS
- B. SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS
- C. SECTION 03 40 00 – PRECAST CONCRETE FOR SKATEPARKS

PART 2 – PRODUCTS

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified, and as necessary to complete the contract, including, but not limited to bowl steel coping, ledge steel edging, handrails, and grind rails.
- B. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in the finished product.

PART 3 - EXECUTION

- A. All welding shall conform to requirements of aws standards. All welding shall be shielded metal arc welding. Welds in finish work shall be filled out flush, ground and distressed. .
- B. Using skilled workers, form and fabricate items of work as indicated and as required to meet installation conditions. Make provisions to connect with or receive the work of other trades.

- C. Unless otherwise indicated, weld or bolt connections between members. Where possible, conceal connections on the finished work. Fit or miter exposed joints to hairline tolerance or use welded joints. On finished surfaces, grind all welds smooth and flush with base metal.
- D. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
- E. Cap all exposed tube or pipe ends. Use size and thickness of material shown. Properly fit and weld cap at joint, grind weld smooth and flush with base metal.
- F. Bend pipe or tubing without collapsing or deforming the walls, so as to produce a smooth uniform curved section and maintain uniform sectional shape.
- G. Where items are to be imbedded in concrete or masonry, provide welded-on anchors or lugs as indicated or required.
- H. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.
- I. Fastening to in-place construction: provide anchoring devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction including threaded fasteners for concrete inserts, or other connectors as required.
- J. Galvanizing repair - use a high zinc dust content paint for re-galvanizing welds in galvanized steel. Hot galvanized solder is also acceptable. Use rust-oleum cold galvanizing compound spray, or similar.
- K. Powder coating repair—use an appropriately color matched powder coat touch-up spray paint on welded or damaged powder coated surfaces.

END OF SECTION 05 50 00

SECTION 07 21 50 – BUILDING ENCLOSURE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes materials
 - 1. Planting occurs at street level and on upper building levels.
 - 2. Underdeck roof joist bay sprayed polyurethane foam insulation.
 - 3. Installation materials.
 - 4. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 09 81 33 for acoustical insulation.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the insulation or accessory manufacturer, as the context admits, manufacturer, unless otherwise indicated.
 - 2. Thermal Transmittance (U-value): Means the measure of heat flux (flow of energy per unit of area per unit of time) and is expressed in units of BTU per hour square foot degrees Fahrenheit of air to air temperature difference between the two sides of a material (Btu/sq. ft. x h x deg. F).
 - 3. Thermal Resistance (R-value): Means the designation of an insulation material's resistance to heat flux. The R value is numerically equal to the reciprocal of the material's thermal transmittance, and is expressed in units of degrees Fahrenheit hour square foot per BTU inch at 75 degrees Fahrenheit (deg. F x h x sq. ft./Btu x in. at 75 deg. F).
 - 4. Concealed: Means hidden behind other construction when complete; and exposed surfaces in areas designated as shelled spaces.
 - 5. Exposed: Means remaining seen after construction is complete.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Fiberglass and mineral wool insulation used in plenum spaces must be fully encapsulated.
 - 2. Plastic insulation must be separated from the building interior by a thermal/fire barrier that prevents the temperature rise to not more than 250 deg. F in a 15- minute time period.
 - 3. Both board insulation and spray applied foam insulation manufactured with blowing agents known to have ozone depleting potential (ODP) are prohibited.
- B. Performance Requirements: Above grade exterior perimeter walls must include insulation having a minimum R-value of at least R-21 for insulation material only, unless otherwise indicated.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished insulation.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project- specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Continuous and cavity wall insulation must conform to the requirements of International Building Code and have a maximum FSI Value of 25 or less and a maximum SDI Value of less than 450 (Class A), when tested in conformance with ASTM E 84.
 - 2. Continuous and cavity wall insulation must be tested along with supporting framework and cladding systems and found in conformance with National Fire Protection Association publication National Fire Protection Association publication NFPA 285, "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components".
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished insulation.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project- specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items. Contractor shall submit soil samples for testing, per this Specification.

- B. Storage: Store unloaded items as shipped in their original packaging, indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
- C. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- D. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Existing Conditions: Surfaces receiving insulation must be dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fiberglass Blanket Insulation: Provide products manufactured by one of the following, or equal.
 1. CertainTeed Corp.
 2. Johns Manville.
 3. Knauf Insulation.
 4. Owens Corning Fiberglass Corp.

2.2 FIBERGLASS BLANKET INSULATION

- A. Description: Unfaced inorganic glass-fiber blanket insulation conforming to ASTM C 665 Type I insulation requirements (blankets without membrane coverings). Fiberglass Blanket
- B. Insulation: Provide products manufactured by one of the following, or equal.
 1. CertainTeed Corp. "CertaPro AcoustaTherm Batts" manufactured by CertainTeed Corp.
 2. "JM Formaldehyde-Free" manufactured by Johns Manville.
 3. "EcoBatt Insulation" manufactured by Knauf Insulation.
 4. "EcoTouch" manufactured by Owens Corning Fiberglass Corp.
- C. Requisite Properties:
 1. Minimum Thermal Resistance: Provide material having an R-value of at least R-4.2 per inch of thickness.
 2. Minimum Size: Provide sizes required for a self-supporting friction fit.
 3. Minimum Thickness: At least 6-1/4 inches.
 4. Minimum Density: At least 0.75 pounds per cubic foot.
 5. Facing: None.

2.3 SPRAYED POLYURETHANE FOAM INSULATION

- A. Description: Closed-cell rigid polyurethane cellular plastic foam insulation produced with a low Global Warming Potential (GWP) and with an Ozone Depletion Potential (ODP) of zero..

- B. Product: “JM Corbond IV” manufactured by Johns Manville, or equal.
- C. Fiberglass Blanket Insulation: Provide products manufactured by one of the following, or equal.
 - 1. Minimum Thermal Resistance: Provide material having an R-value of at least R-3.8 per inch of thickness.
 - 2. Thickness: Indicated on the Drawings.
 - 3. Core Density: 2.0 pounds per cubic foot, when measured in conformance with ASTM D 1622.
 - 4. Closed-Cell Content: Greater than 90 percent, when measured in conformance with ASTM D 6226.
- D. Performance Requirements
 - 1. Maximum Air Permeance: Not more than 0.00055 liters per second per meter at 75 Pascals of pressure change, when measured in conformance with ASTM E 2178.
 - 2. Maximum Water Vapor Transmission: Not more than 0.61 perms at 1.5-inch thickness, when measured in conformance with ASTM E 96.
 - 3. Surface Burning Characteristics: Class I (or A); not more than the following, when tested in compliance with ASTM E 84.
 - a. Maximum FSI Value: Not more than 25.
 - b. Maximum SDI Value: Not more than 450.

2.4 INSTALLATION MATERIALS:

- A. Mechanical Fasteners: Tape, staples, and other devices for fastening insulation supplied, required, recommended, or accepted by the insulation manufacturer.
- B. Hanger Wire: At least 0.106-inch diameter (SWG 12) soft temper zinc-coated wire conforming to ASTM A 641, Class 3 or A coating.
- C. Adhesive: Supplied, required, recommended, or accepted by the insulation manufacturer to bond insulation securely to substrates indicated without damaging insulation or substrates.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer’s requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer’s instructions and other requirements and recommendations.

2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION:

A. General Requirements:

1. Install insulation using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
2. Extend insulation to envelop entire area insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
3. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
4. Installed insulation must be warrantable. Do not install, correct, or replace insulation in a manner that results in any warranty or guarantee becoming void.

B. Special Techniques:

1. Stud Bay Insulation: Install insulation in cavities formed by framing members.
 - a. Use insulation that fills the cavities. If more than one length is required to fill the cavities, then provide lengths that will produce a snug fit between ends.
 - b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - c. Maintain 3-inch clearance around recessed lighting fixtures not rated for or protected from contact with insulation.
 - d. Stuff loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to roughly 40 percent of normal maximum volume.
 - e. For metal-framed wall cavities higher than 96 inches, support unfaced blankets mechanically and support faced blankets by taping insulation flanges to metal stud flanges.
2. Ceiling Insulation
 - a. Install blanket insulation above ceilings where indicated.
 - b. Maintain 3-inch clearance of insulation around recessed lighting fixtures.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include:
 1. Written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

3.4 CLEANUP

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed insulation in place from becoming wet, deterioration, and damage until covering.
- B. Do not store anything adjacent to or against installed insulation unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed insulation as work surfaces.
- C. Remove protection when it's no longer needed and before covering.

END OF SECTION 07 21 50

SECTION 07 55 23 – EPDM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes materials
 - 1. EPDM membrane roofing.
 - 2. Roofing insulation and cover board.
 - 3. Installation materials.
 - 4. Site tests and inspections.
 - 5. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 09 81 33 for acoustical insulation.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the roofing manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Verify chemical and adhesive compatibility of selected roofing with installed curing compounds and installed moisture vapor emission control systems, based on current product formulations.
- B. Preinstallation Meeting:
 - 1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 - 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation
 - 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, or performance of installed roofing. Resolve each condition.
 - 4. Finalize construction schedule.
 - 5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.
- C. Sequencing:
 - 1. Install roofing only after concrete is cured to a condition of equilibrium; is sufficiently dry to bond with roofing adhesives; and has alkalinity (pH), MVER, and RH within ranges required, recommended, or accepted by the manufacturer. Provide chemically and adhesively compatible treatment when required or necessary to reduce pH and MVER to within allowable limits required, recommended, or accepted by the manufacturer.

2. Substrate repairs must be completed after surface preparation.

D. Scheduling:

1. Concrete Curing: Allow enough time in the construction schedule for concrete to cure for at least 28 days before beginning surface preparation and installation.
2. Primer Installation: Roofing must be applied within 24 hours of primer installation. Re-prime surfaces exposed for more than 24 hours; follow manufacturer's instructions for re-priming.
3. Access Restrictions: Close spaces during installation; keep closed to foot traffic after installation for at least 48 hours and to rolling traffic for at least 72 hours.

1.4 SUBMITTALS

A. Action Submittals: Submit the following for responsive action (formal review and approval).

1. Product Data:
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
2. Shop Drawings:
 - a. Submit project-specific dimensioned plans drawn to scale showing roofing installation. Show locations and extents of all items and accessories. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing substrate joints and cracks, flashings, coating penetrations, transitions, terminations, and other conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans.
3. Samples: Submit at least an 8- by 10-inch representative roofing sample for each specified variety, with a lapped seam in the center of each sample.

B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).

1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished roofing.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
3. Manufacturer's Representative Reports:
 - a. Before beginning work, request and submit reports confirming substrates are properly prepared in conformance with manufacturer's instructions and other requirements and recommendations; are acceptable and satisfactory to receive the

- work of this specification section; and conform to all requirements necessary to issue specified and other warranties.
 - b. During the work, request and submit reports documenting actions taken by the manufacturer's representative to verify conformance with manufacturer's instructions and other requirements and recommendations.
 - c. Upon completion, request and submit reports confirming installed roofing conforms to all requirements necessary to issue specified and other warranties.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
 - 1. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Roofing must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
 - 1. Fire Resistance Rating: Roof coverings must conform to UL 790 fire resistance requirements for Class A rating. (effective against severe fire test exposures).
- C. Qualifications:
 - 1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing roofing installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
 - 2. Installer: Company or individuals must have at least 5 years' experience installing roofing for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - 3. Supervisors: Individuals must have at least 7 years' experience installing roofing for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading roofing installers.
 - 4. Manufacturer's Representative: Individuals must have at least 5 years' technical field experience performing manufacturer's services for at least 50 previous projects similar to this project in size, material, design, and complexity.
- D. Field Samples: Include in-situ mockups as part of the work of this specification section.
 - 1. Install at least one 100-square-foot field sample of each roofing membrane installation to verify selections made under sample submittal and to set quality standards for installation. Demonstrate surface preparation, crack repair, and joint, and corner preparation.
 - 2. Perform sheet moisture test in conformance with ASTM 4263.

3. Test roofing membrane adhesion to verify surface preparation.
4. The Architect reviews field samples for conformance to the Contract Documents and approves or rejects them as the standard by which subsequent work is evaluated.
5. Revise field samples and repeat reviews, including arranging all revisions and paying all revision costs, until accepted in writing by the Architect. Final acceptance of roofing is made from field samples.
6. After acceptance, promptly identify and protect field samples for reference until Substantial Completion.
7. Approved field samples may remain part of the work after being identified for future reference.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage during storage.
 1. Prevent stored items from contacting the floor or ground and from deterioration and damage.
 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 4. Sheet products must be tightly rolled face out on a sturdy core designed for that purpose and vertically stored unless otherwise required or recommended by the manufacturer
 5. Promptly remove and replace rolled sheet products that are flattened or distorted during shipping, unloading, or storage.
 6. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage, including heat and sudden changes in temperature, and UV exposure beyond manufacturer- recommended limits.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
 1. Avoid damage to packaging and containers, and contamination of contents.
 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective roofing materials with undamaged new roofing materials that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install roofing only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
 - 1. Do not install roofing during rain or snow, fog or mist; or when rain or snow is predicted within 24 hours of installation.
 - 2. Proceed only when there is no threat of impending precipitation, and both current and forecasted weather conditions conform to those required, recommended, or accepted by the manufacturer.
 - 3. Apply only as much roofing as can be made weathertight each day, including all flashing and detail work. Apply uninterrupted waterstops at the end of each day's work, and completely remove them before proceeding with the next day's work.
- B. Existing Conditions: Surfaces receiving roofing must be dry. Install roofing only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
- C. Other Conditions: Do not apply roofing where dust is generated, or liquids are sprayed.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 20 years.
- B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 ROOFING MEMBRANE

- A. Product: Indicated on the Drawings, Sheet A-052, or equal.

2.2 ROOFING INSULATION AND COVER BOARD

- A. Polyisocyanurate Insulation:
 - 1. Description: Rigid, faced, closed-cell polyisocyanurate insulation conforming to ASTM C 1289 Type II (coated fiberglass facers) Class 2 (20psi) requirements .
 - 2. Products: "Carlisle SecurShield Polyisocyanurate", or equal.
 - 3. Requisite Properties:
 - a. Long Term Thermal Resistance: Assumed LTTR value of 5.6 per inch of thickness. If proposed insulation LTTR is less than 5.6 per inch, seek a written interpretation from the Architect to determine the necessary minimum thickness required to achieve specified R-values.
 - b. Minimum Compressive Strength: At least 20 pounds per square inch, when measured at either 5 percent deformation or yield, whichever occurs first.

- c. Minimum Density: At least nominal 2.0 pounds per cubic foot when measure in conformance with ASTM 1622.
 - d. Minimum Tapered Insulation Thickness: At least 1-1/2 inches.
 - e. Tapered Insulation Main Slope: 1:48 (1/4-inch in 12 inches).
- B. Cover Board:
 - 1. Application: Used in horizontal applications as an overlayment for roof insulation and in vertical applications as a liner for the roof side of parapet walls.
 - 2. Description: Commercial glass mat faced exterior sheathing conforming to ASTM C 1177 requirements for glass mat gypsum substrate.
 - 3. Products: “DensDeck” manufactured by GP Building Products, or equal.
 - 4. Horizontal Applications: Provide 1/4-inch thick panels over insulation; provide at least 1/2-inch thick cover board directly over metal decks without insulation.
 - 5. Vertical Applications: Provide 1/2-inch thick panels.
 - a. 1/4-inch roof cover board and gypsum sheathing are prohibited for vertical applications.
 - b. Roof cover boards installed in vertical applications (including as a liner for the roof side of parapet walls) must be installed by the same roofing installer that installs roof cover boards in horizontal applications (including as an overlayment for roof insulation).
 - c. Non-conformance with the above may negatively affect the specified warranty.

2.3 INSTALLATION MATERIALS

- A. Fasteners and Stress Plates:
 - 1. Insulation and Roof Cover Board: “HP Fastener”, or equal, carbon steel threaded fasteners treated with corrosion-resistant coating; used with “Insulation Fastening Plates” 3-inch metal stress plate to attach insulation and roof cover boards directly to 15/32-inch-thick wood or 7/16-inch OSB decks.
 - 2. Roof Membrane: “HP-X Fastener”, or equal, carbon steel threaded fasteners treated with corrosion-resistant coating; used with “PIRANA Plate” 2-3/8-inch diameter stress plate to attach membrane to 16- to 24-gage steel and 15/32-inch-thick wood roof decks.
 - 3. Other Fasteners: Supplied, required, recommended, or accepted by the manufacturer.
- B. Tape: “SecurTAPE”, or equal, long splice tape supplied, required, recommended, approved, or accepted by the manufacturer.
- C. Sealant: “Universal Single-Ply Sealant” single-component polyether sealant, or other sealant supplied, required, recommended, or accepted by the manufacturer.

2.4 ACCESSORIES:

- A. Vapor Retarder:
 - 1. Membrane: “VapAir Seal 725TR”, or equal, self-adhering rubberized asphalt air and vapor barrier.
 - 2. Primer: “CCW-702LV”, or equal, high-tack adhesive.
 - 3. Adhesive: “CAV-GRIP”, or equal, low-VOC contact adhesive.

- B. Flashing and Detail Membrane: “Sure-Seal Pressure Sensitive Elastoform Flashing”, or equal, uncured EPDM flashing material laminated to “SecurTAPE”.
 - 1. Thickness: 60 mils.
 - 2. Color: Match roofing membrane color.
 - 3. Primer: “EPDM Low VOC Primer”, or equal.
- C. Flashing Accessories:
 - 1. Termination Bar: “Metal Fastening Bar”, or equal, one inch wide by 98-mil thick extruded aluminum bar pre-punched at 6 inches on center and incorporates a sealant ledge to support sealant and provide increased stability for membrane terminations
 - 2. Prefabricated Flashings:
 - a. Prefabricated Corners: “Sure-Seal Inside/Outside Corner”, or equal, 60-mil EPDM flashing material laminated to “SecurTAPE”.
 - b. Single-Pipe Penetration Pipe Boots: “Sure-Seal EPDM”, or equal, 60-mil thick pressure-sensitive (PS) pipe seals laminated to “SecurTAPE” for flashing single rooftop vent stacks and pipes.
 - c. Multiple Penetrations: “Sure-Seal PS Pourable Sealer Pocket”, or equal, prefabricated, interlocking, 2-inch, injection molded, plastic support and pre-formed deck flanges laminated to “SecurTAPE”.
 - d. Pourable Sealer: “One-Part Pourable Sealer”, or equal, one-part, moisture curing, elastomeric polyether sealant used to fill molded TPO sealant pockets.
- D. Roof Walkways:
 - 1. Description: Pressure sensitive molded walkway protection pads.
 - 2. Application: Used to protect roofing membrane from mechanical abuse, including regular rooftop maintenance.
 - 3. Product: “Sure-Seal EPDM PS Molded Walkway Pads”, or equal.
 - 4. Requisite Properties
 - a. Size: 30 inches square by 3/8-inch thick.
 - b. Color: Black.
 - c. Layout: Conform to the lengths and locations indicated on shop drawings.
- E. Other Accessories: Provide other accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: With installer and manufacturer’s representative present, examine project conditions, including supporting and adjacent construction, and other conditions under which roofing is installed.
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer’s instructions and other requirements and recommendations.

2. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with roofing adhesion, appearance, or performance.
- C. Evaluation and Assessment:
1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION:

- A. Substrate Preparation:
1. Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
 2. Remove substrate coatings and other substances that are incompatible with adhesives or that may negatively affect the quality of the installation, durability, or performance of furnished roofing.
 3. Remove substrate ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with leveling and patching compound. Apply, trowel, and float patching compound to achieve smooth, flat, hard surface.
- B. Termination and Penetration Preparation
1. Prepare surfaces at terminations and penetrations through roofing and at expansion joints, drains, and sleeves in conformance with ASTM C 898 (horizontal applications) and the manufacturer's application instructions.
 2. Prime substrates, unless otherwise required or recommended by the manufacturer.
- C. Joint and Crack Preparation:
1. Differentiate between treatment of moving versus unmoving joints, and of cracks of different widths.
 2. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 (horizontal applications), ASTM C 1471 (vertical applications) and the manufacturer's instructions. Before coating surfaces, remove dust and dirt from joints and cracks in conformance with ASTM D 4258.
 - a. Comply with ASTM C 1193 for joint-sealant installation.
 - b. Apply bond breaker between sealant and preparation strip.
 3. Install sheet flashing and bond to the deck and wall substrates where indicated or required, and in conformance with the manufacturer's instructions. Extend sheet flashings onto perpendicular surfaces and other work penetrating substrate.
- D. Substrate Acceptance:
1. Differentiate between treatment of moving versus unmoving joints, and of cracks of different widths.
 - a. properly prepared in conformance with the specifications, with the manufacturer's application instructions, and in a manner that does not void specified warranties; and
 - b. satisfactory and ready to receive roofing.

2. Request and accommodate the manufacturer's representative's presence as required thereafter to review application progress, review completed work, and issue specified warranties.
3. Perform adhesion testing prior to start of work in each area.

3.3 INSTALLATION

A. General Requirements:

1. Install roofing using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
2. Only install roofing under conditions that ensure membrane is free from blemishes and defects.
3. Completed work must match approved samples and mockups, as accepted by the Architect.
4. Installed roofing must be warrantable. Do not install, correct, or replace roofing in a manner that results in any warranty or guarantee becoming void.

B. Roof Insulation Special Techniques:

1. Install tapered insulation in conformance with the slopes indicated.
2. Install insulation to thickness required to conform to specified performance requirements. Where overall insulation thickness is 2.7 inches or greater, install 2 or more layers with joints of each succeeding layer staggered at least 6 inches in every direction from the previous layer's joints.
3. Trim surface of insulation at roof drains where necessary so that completed surfaces are flush and do not restrict flow of water.
4. Install insulation with long panel joints in a continuous straight line; and with end joints staggered between rows, abutting edges, and ends between boards.
 - a. Fill gaps exceeding 1/4 inch with insulation.
 - b. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

C. Adhered Insulation Base Layer Special Techniques: Install each layer of insulation and adhere to the substrate.

1. Adhesive Ribbons: Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2. Full Spread Adhesive: Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Adhered Tapered Insulation Special Techniques:

1. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
2. Adhere insulation in conformance with the requirements of FMG Approvals' "RoofNav" for specified Windstorm Resistance Classification.

E. Roof Cover Board Special Techniques:

1. Install cover boards over insulation with long joints in continuous straight lines; and with end joints staggered between rows.
2. Offset cover board joints at least 6 inches in every direction from insulation board joints below.
3. Loosely butt cover boards together.

- F. Adhered Cover Board Special Techniques:
1. Comply with manufacturer's installation instructions for coverage rates, set times, and other adhesive application guidelines and requirements.
 2. Adhere cover boards in conformance with the requirements of FMG Approvals' "RoofNav" for specified Windstorm Resistance Classification.
- G. Adhered Cover Board Special Techniques:
1. Apply roofing membrane over area indicated as receiving roofing in conformance with the manufacturer's application instructions.
 - a. Unroll roofing membrane and allow to relax before installing.
 - b. Install sheet according to ASTM D 5036. Comply with manufacturer's installation instructions for coverage rates, set times, and other adhesive application guidelines and requirements.
 2. Begin roofing membrane application in the presence of the manufacturer's field representative.
 3. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
 4. Apply bonding adhesive to the substrate at rate required by the manufacturer. Do not apply bonding adhesive to splice area of the roofing membrane.
 5. Roll felt backed membrane into adhesive coat immediately and while still wet. To ensure proper contact, compress bonded half of sheet to substrate with a water-filled, foam covered, lawn roller. Fold un-adhered half of membrane sheet back onto itself, and repeat the bonding procedure to complete bonding of sheet. Lay smooth in order to minimize wrinkles.
 6. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
 7. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
 8. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Seam overlaps must be 3 inches wide when automatic machine welding and 4 inches wide when hand welding.
 - b. Overlaps must be with the flow of water where possible.
 - c. Welding equipment must be provided by or be approved by the membrane manufacturer. Mechanics intending to use the equipment shall have successfully completed a training course provided by a manufacturer's representative prior to welding.
 - d. Membrane surfaces to be welded must be clean and dry in accordance with the manufacturer's instructions. No adhesives must be present in the lap areas.
 - e. Test lap edges with probe to verify seam weld continuity.
 - f. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - g. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
 - h. Grind edge of the membrane at corner laps as required to avoid pinholes at T-joints.
- H. Hand-Welding Special Techniques: Hand-welded seams must be completed in three stages. Hot-air welding equipment must be allowed to warm up for at least one minute prior to welding.

1. The lap must be tack welded every 3 feet to hold the seam in place.
 2. The back edge of the seam must be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
 3. The nozzle must be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller must be positioned perpendicular to the nozzle and rolled lightly.
- I. Hand-Welding Special Techniques: Hand-welded seams must be completed in three stages. Hot-air welding equipment must be allowed to warm up for at least one minute prior to welding.
1. The lap must be tack welded every 3 feet to hold the seam in place.
 2. The back edge of the seam must be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
- J. T-Joint (Three-Way Lap) Special Techniques:
1. When welding a three-way overlap with membrane thicker than 1.5 mm, the top edge of the second membrane layer must be shaved down to create a smooth transition for the top membrane layer to conform to for positive welding.
 2. Chamfer the edge of the membrane using means and methods acceptable to manufacturer.
- K. Welded Seam Quality Control:
1. Completed welded seams must be checked by the installer after cooling for continuity using a rounded screwdriver or other suitable blunt object.
 2. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of black material from the edge of completed joints.
 3. On-site evaluation of welded seams must be made daily by the Contractor at locations as directed by the membrane manufacturer's representative.
 4. 2 inch wide cross-section samples of welded seams must be taken at least three times a day through completed seams.
 5. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut must be patched by the Contractor at no extra cost to the Owner.
 6. Welded seams must be left exposed until inspected and accepted by the membrane manufacturer.
- L. Deck Drain Special Techniques Prime flange at deck drains and spread sealant bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- M. Sealing Deck to Parapets: Seal the deck to the parapets and penetrations with urethane foam, suitable sealant, or self-adhesive vapor barrier in conformance with the manufacturer's installation instructions or other guidelines.

3.4 FIELD QAULTY CONTROL

- A. Site Tests and Inspections:
1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.

- a. Schedule and arrange all tests and inspections.
 - b. Coordinate all work and the final construction schedule with all tests and inspections.
 - c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.
 - d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site tests and inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
2. Required Tests:
- a. Adhesion Testing: Before beginning work in each area, conduct adhesion tests with manufacturer's representative present at start of installation over each new substrate.
 - b. Weld Testing: To ensure properly-welded seams, perform test welds in the morning before starting, after lunch, and anytime there is a change in weather. Before Final Completion, deliver to the Owner signed, dated, and time stamped test welds as a condition of project closeout.
- B. Manufacturer Services: Installed work is subject to examination by the manufacturer's representative to determine conformance to manufacturer's instructions and other requirements and recommendations.
- 1. Note all defective items and non-conforming work identified by the manufacturer's representative.
 - 2. Itemize into a punch list all noted items and record the manufacturer's requirements and recommendations for correcting each punch list item.
 - 3. Promptly bring all punch list items into conformance with the manufacturer's requirements and recommendations until accepted in writing by the Architect.
 - 4. Manufacturer's representative withholds issuing warranties until all punch list items are accepted by the Architect.

3.5 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include

1. written descriptions of non-conforming, damaged, and defective work;
2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

3.6 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.7 CLOSEOUT ACTIVITIES

- A. Manufacturer's Services: Before examination and acceptance of installed roofing by the manufacturer's representative, convene a meeting at the project site with the manufacturer's representative to review completed work and issue warranties.
 1. Invite all parties to attend that were either present at the preinstallation meeting, or that should have been present but were not in attendance
 2. Notify invitees at least 10 business days before convening the meeting.

3.8 PROTECTION

- A. Protect installed roofing in place from deterioration and damage until covering.
- B. Do not permit foot or vehicular traffic onto unprotected roofing membranes.
- C. Do not store anything on, adjacent to, or against installed roofing unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed roofing as work surfaces.
- D. Remove protection when it's no longer needed and before covering.

END OF SECTION 07 55 23

SECTION 07 57 13 – BASF SEAMLESS SILICONE/POLYURETHANE INSULATED ROOF SYSTEM FOR NEW CONSTRUCTION OR RETROFIT APPLICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included
 - 1. Preparation of Substrate.
 - 2. BASF SKYTITE® C Series-2.8 Sprayed-in-place Polyurethane Foam (SPF) Insulation.
 - 3. BASF SKYTITE® S-5001 Roof Coating.
 - 4. Roofing Granules.
 - 5. Walkways.

1.2 RELATED WORK:

- A. Section 01410: Testing Laboratory Services.
- B. Section 03300: Cast-in-Place Concrete
- C. Section 05300: Metal Decking
- D. Section 06100: Rough Carpentry
- E. Section 07600: Flashing and Sheet Metal
- F. Section 07700: Roof Specialties and Accessories
- G. Section 07700: Roof Specialties and Accessories

1.3 RELATED DOCUMENTS

- A. The codes, standards and practices listed shall be the latest edition. ASTM refers to ASTM International.
 - 1. ASTM C 518 – Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 2. ASTM D 93 – Standard Test Methods for Flash Point by Penske-Martens Closed Cup Tester
 - 3. ASTM D 115 – Standard Test Methods for Testing Solvent Containing Varnishes
 - 4. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
 - 5. ASTM D 562 – Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer
 - 6. ASTM D 822 – Standard Practice for Filtered Open Flame Carbon Arc Exposures of Paint and Related Coatings
 - 7. ASTM D 903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
 - 8. ASTM D 1004 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
 - 9. ASTM D 1293 – Standard Test Methods for pH of Water

10. ASTM D 1310 – Standard Method for Flash Point and Fire Point of Liquids by Tag Open Cup Apparatus
11. ASTM D 1353 – Standard Method for Non Volatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer and Related Products
12. ASTM D 1475 – Standard Test Method for Density of Liquid Coatings, Inks and Related Products
13. ASTM D 1621 – Standard Test Method of Compressive Properties of Rigid Cellular Plastics
14. ASTM D 1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics
15. ASTM D 2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Heat Aging
16. ASTM D 2240 – Standard Test Method for Rubber Property Durometer Hardness
17. ASTM D 2856 – Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer
18. ASTM D 4209 – Standard Practice for Determining Volatile and Non-Volatile Contents of Cellulosics, Emulsions, Resin Solutions, Shellac and Varnishes
19. ASTM D 5469 – Standard for SPF Roofing Systems
20. ASTM D 6694 – Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing Systems
21. ASTM D 6705 – Standard for Repair and Recoat of SPF Roof Systems
22. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
23. ASTM E 96 – Standard Test Method for Water Vapor Transmission of Materials
24. ASTM E 108 (UL 790) – Standard Test Method for Fire Tests of Roof Coverings
25. SPFA AY 104 – Spray Polyurethane Foam Systems for New and Remedial Roofing

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Must be a current BASF Approved Team Q Applicator or current applicator of the approved roof system manufacturer.
- B. Roofing applicator must exhibit 5 years and a minimum of 500,000 sq. ft. experience with the selected roofing system, with projects of a similar scope and nature.
- C. A Pre-Bid Conference shall be conducted. Its purpose shall be: To discuss any details of the project not adequately covered within the specification; to allow bidding applicators a period of access to the roof areas; and to review the normal flow of activities at the facility. There will be no other access to the roof area without the consent of the owner's representative. All bidding applicators must attend this Pre-Bid Conference. A list of those companies present will be recorded.
- D. The roofing applicator shall perform the work of this section. Subcontracting installation of the silicone coating/polyurethane foam is not allowed.
- E. Inspections: Completed roofing application will be inspected by an independent inspection firm designated by the warranty provider on a periodic basis.
- F. Ensure that the proposed roofing system will meet both the uplift and reroofing requirements found in the locally enforced building code.

- G. The roofing system manufacturer shall provide proof of SPFA accreditation. Roofing system manufacturer shall have a 5A D&B rating and be ISO 9002 certified or equal.

1.5 SUBMITTALS

- A. Specification Development - The owner/specifier shall supply to BASF manufacturer's representative:
1. A draft copy of the project specification, including: the roofing section, roofing warranty requirements, and roofing drawings. This shall be completed before project goes out to bid.
 2. This draft specification shall be reviewed for general technical acceptance and eligibility for issuance of a warranty. A letter confirming an appropriate application, drawings and specification, based on the current available information, will be delivered to the owner's representative at their request.
- B. Any alternate products shall be submitted to the owner and/or owner's representative 10 days before bid date to allow time for product review. Submittals shall include: all appropriate technical data sheets, manufacturer's references, warranty, follow-up inspection policy and outline, material safety data sheets, and a typical, physical sample (3' x 3') to be used as a standard of quality. Manufacturer shall supply list of geographically appropriate work and list of work of similar size and scope to substantiate their period of performance, see 2:02A.1.
- C. Applicator shall submit to owner's representative at or before time of bid:
1. Reference projects with contacts, substantiating years of experience and completion of minimum prior work submitted by applicator.
 2. Provide specimen copy of warranty.
 3. Submit current ICC ES Report for the roofing system.
 4. Submit Underwriters Laboratory, UL 790 classification, or Factory Mutual, and local building code approvals as required/requested.

1.6 MATERIALS, DELIVERY AND STORAGE

- A. Deliver materials to the site in their original, tightly sealed containers, all clearly labeled with manufacturer's name, product identification and lot number.
- B. Safely store materials in their original containers out of the weather and where the temperatures are within the limits specified by the manufacturer.
- C. All materials shall be stored in compliance with applicable fire and safety requirements.
- D. Protect materials from damage during transit, handling, storage and installation. Applicator shall provide secure site storage trailers.

1.7 ENVIRONMENTAL CONDITIONS

- A. The coating and the polyurethane foam shall not be applied during periods of inclement weather (rain, snow, fog, mist).
- B. Do not apply the polyurethane foam when substrate or ambient air temperatures are below 40°F (7°C) unless specifically approved in writing by the polyurethane foam manufacturer.

- C. Do not apply silicone coatings when temperature is below 40°F (5°C).
- D. When wind speeds exceed 10 miles per hour or adversely affects the quality of the SPF, windscreens shall be used during the application of the polyurethane foam and coatings to prevent overspray onto surfaces not intended to receive foam and coating. Under no circumstances shall the polyurethane foam or silicone coating be applied when wind speeds exceed 25 miles per hour.

1.8 SEQUENCING AND SCHEDULING

- A. The spray polyurethane foam is installed when the deck, parapet walls, rough openings, and curbs are completed. The type of skylights used will determine when skylights should be installed. Plumbing vents, drains, and electrical penetrations should all be in place. There should not be any tradespeople working on the roof when the spray polyurethane foam and silicone coating are being installed.

1.9 WARRANTY

- A. The roof system manufacturer's 10 Year Full System Warranty shall be issued upon completion, inspection and acceptance of the project. Any repairs covered by the warranty are without cost to the Owner throughout the term. The warranty shall be comprehensive with no proration and no cap for repairs.

PART 2 - PRODUCTS

2.1 POLYURETHANE FOAM INSULATION

- A. The coating material and the SPF insulation must be supplied by one manufacturer.
- B. Physical property requirements are as follows, for acceptable insulation products with Zero-Ozone Depleting Potential, such as BASF SKYTITE® C series.

Property	Value	Test Method
Density, sprayed in place, pcf min.	2.7 – 3.0	ASTM D 1622
Compressive Strength, psi, min.	45	ASTM D 1621
Closed-cell content, percent, min	>90	ASTM D 2856
K-factor, aged, max	0.158	ASTM C 518
Dimensional Stability, 28 days, percent volume change, max.	+0.69	ASTM D 2126
Flame spread, max	<75	ASTM E 84

2.2 SILICONE COATING

- A. The silicone roofing membrane shall consist of a minimum two coats of a moisture-cure silicone rubber, liquid applied material, domestically engineered and produced. The two coats shall be of contrasting colors. The minimum two-coat thickness shall be 20 dry mils.
1. The silicone coating will be a product proven through actual roof performance for a period of time equal to, or longer, than the term of the requested warranty.
 2. The manufacturer shall have an established program to rapidly respond to any required warranty repair, if the original applicator is unable to perform standard repairs.
 3. The BASF SKYTITE® S-5001 LS moisture-cure silicone rubber coating has the following minimum properties:

Property	Value	Test Method
As Supplied:		
Solids Content by weight, percent	77	ASTM D 4209
Solids content by volume, percent	62	Calculated
Weight (lbs) per gallon	11.18	ASTM D 1475
Flash Point, Pensky-Martin closed cup, F, min	119	ASTM 93-PMCC
Volatile Organic Content (VOC), (g/l)	<250	EPA Method 24
As Cured:		
Durometer Hardness, Shore A, points	35-40	ASTM D 2240
Tensile Strenght, die C, psi	270	ASTM D 412
Elongation, percent	350	ASTM D 412
Permeability, perms	2.9 @ 30 mils	ASTM E 96

2.3 SEALANT

- A. Sealant shall be a pigmented silicone sealant such as Dow Corning® Contractors Weatherproofing Sealant. The color of this sealant, if exposed, shall closely match that of the topcoat.

2.4 SUBSTRATE PRIMER

- A. Securock® – if kept clean, with little dust, will not require a primer.
- B. For B.U.R., concrete, wood, brick, metal (ferrous, not rusted), and most ‘painted’ metal - the primer must be approved by BASF Corporation, such as a water-based epoxy primer, BASF SKYTITE® 1800.
- C. For non-ferrous metals (cleaned aluminum, galvanized copper, etc) - a primer shall be required, which is approved by BASF Corporation. Such a primer is DTM by Sherwin Williams.
- D. Cut-back asphalt primers are not to be used.

2.5 GRANULES

- A. Granules shall be number 11 screen size, ceramic-coated roofing granules as manufactured by the Industrial Products Division of 3M Company or equal, color to best match topcoat.
- B. Quartz or silica aggregate such as Kafka Quartz granules, this product will have natural color variations, color should be selected to match topcoat.

2.6 PROTECTIVE COVERING / WALKWAYS

- A. As required a weather-resistant, breathable, resilient pad composed of synthetic rubber strands shall be installed to create additionally protected roof areas. This product shall be approved by BASF. Such a walkway is Yellow Spaghetti, as manufactured by Western Plastics, Inc.
- B. Walkways may also be constructed by marking out the walk path, adding an additional 10-15 mils seeded with additional granules or aggregate. This coating shall be in light but contrasting color as well as granules to match.

2.7 GYPSUM BOARD

- A. Shall be a ½” Securock® or a glass matt faced, moisture-resistant core gypsum board. Follow application instructions and only select cover boards compatible with SPF.
- B. Verify with a roof consultant on whether the EPDM Membrane is required to be cut or have slits made in it in order to provide a passage for vapor diffusion, should the vapor retarder end up in the middle of the insulation system.
- C. Shall be a ½” SecuRock® or a glass matt faced, moisture-resistant core gypsum board designed for use with SPF. Locate edge joints on, and parallel to deck ribs. Stagger end joints of adjacent lengths of SecuRock Gypsum-Fiber roof board. In typical installations, butt board edges and ends loosely or as per manufacturer’s instructions. Long, uninterrupted runs (greater than 200 feet) of SecuRock Gypsum-Fiber roof board will require slight gapping due to thermal expansion.
- D. Consult your roof designer for direction how to handle the present vapor retarder between insulation systems.

2.8 POLYISO INSULATION BOARD

- A. Shall be a closed-cell polyisocyanurate foam core integrally laminated to inorganic coated glass fiber facers, such as Atlas AC IV.
- B. Polyiso insulation board should be conditioned and dry before being installed. Follow NRCA Guidelines as well as the Manufacturer's instructions.
- C. A cover board may need to be applied over the Polyiso insulation board if the insulation is not firmly adhered to the substrate.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. A. Verify that all surfaces to receive polyurethane foam insulation are clean, dry and free of dust, dirt, debris, oil, solvents and all materials that may adversely affect the adhesion of the polyurethane foam. All components of the roofing system shall be evaluated before the spray foam application to ensure they are sound, secure, and free of moisture.
- B. B. Do not begin applying polyurethane foam insulation until substrate and environmental conditions are satisfactory. An infrared scan must be performed and documented prior to any roofing work, to determine if there is any moisture trapped within the existing roof system. All wet materials must be removed and replaced with like type materials. In addition to the infrared moisture scan perform other standard roofing forensics investigation or use the BASF SPF Recover/Recoat checklist.
- C. Make sure that the height of all roof details will accommodate the spray foam application thickness and provide for positive roof drainage before starting the spray foam application.
- D. Prior to polyurethane foam application, inspect and confirm existing edge attachment follows IBC Chapter 15, 1504.5 Edge securement of low-slope roofs.
- E. Ensure that all edge metal details are brought to current SPFA industry standards by confirming a v-groove and sealant is installed.
- F. Identify the air intakes and HVAC units with a knowledgeable building representative. HVAC units and intake in the immediate area or downwind of area must be shut off and sealed by masking to prevent coating fumes from entering the building. The building areas may need to be vacated until all fumes have dissipated.

3.2 SURFACE PREPARATION:

- A. EPDM & Thermoplastic Roof Membranes:
 - 1. Clean membrane by pressure washing with clean tap water to remove all dirt, dust, oils and other contaminants.
 - 2. Remove all wet insulation under existing roof membrane. Clean and dry the area and install new similar compatible insulation to the level of the adjacent existing membrane.

3. Remove or fasten adhere all loose or damaged roof membrane, properly adhering to form a solid substrate. Cutback products shall not be used. Make sure the adjoining roof materials around these defects are dry.
4. Cut membrane around details, projections and edge terminations or any areas where the membrane is stretched tight.
5. Primer(s) – Install “Adhere it” primer by GAF Products per manufacturer's recommendations. Make sure all surfaces are clean and dry prior to primer and/or polyurethane foam application.

3.3 POLYURETHANE FOAM APPLICATION

A. Inspection:

1. Prior to polyurethane foam application, inspect the substrate surface to ensure preparations required in Section 3.02 have been met.
2. Polyurethane foam shall not be applied unless the environmental requirements of Section 1.06 are met.

B. Application:

1. All objects that require protection from overspray shall be protected; all mobile objects shall be moved to an acceptable area. All intake air vents shall be turned off and covered or alternative plans made if units cannot be shut down to avoid airborne roof components entry into the building.
2. Apply the polyurethane foam in strict accordance with the polyurethane foam manufacturer's specifications and application instructions, using spray equipment recommended by the SPF manufacturer. The field of the roof shall be applied, as practical, by a robotic SPF application device. The robotic method shall improve consistency, slope-to-drain, and visual appearance.
3. Polyurethane foam shall be applied in a minimum of ½-inch thick to a maximum of 1.5” thick passes at one time. The cool down time of 20 minutes before adding another pass or lift is required and repeated until the overall desired thickness is achieved. The total thickness of the polyurethane foam shall be a minimum of 1.5 inches (or more for additional insulation value), except in small areas where tapering is required to facilitate drainage.
4. Apply the full thickness of polyurethane foam in any area on the same day.
5. Polyurethane foam shall be applied to ensure positive drainage, resulting in no ponding water. Ponding water is defined as “an area of 100 square feet or more which holds in excess of ½ inch of water as measured 24 hours after rainfall and followed by drying conditions.”
6. The polyurethane foam shall be terminated neatly a minimum of 4 inches above the finished roof surface at roof penetrations. Sprayed-in-place cants shall be applied and slowly built up to allow a smooth transition from the horizontal to vertical surface.
7. The finished polyurethane foam surface texture shall be “smooth to orange-peel”, free of voids, pinholes and depressions and ready to receive coatings. “Verge of popcorn” texture is acceptable if it can be thoroughly and completely coated. Popcorn and tree bark textures are not acceptable. Unacceptable SPF textures shall be corrected and re-sprayed prior to the coating application.
8. It is acceptable to prevent UV degradation, to cover exposed foam with 1 gps of Dr. Grey acrylic coating until silicone coating application begins. Coating surface shall be free of moisture, dust, dirt, debris and other contaminants that would impair the adhesion of the silicone coating system.

3.4 SILICONE ROOF COATING APPLICATION

A. Inspection:

1. Prior to the application of silicone coating, inspect the polyurethane foam surface to ensure the conditions of Section 3.03 have been met.
2. The polyurethane foam surface shall be free of moisture, dust, dirt, debris and other contaminants that would impair the adhesion of the silicone coating.
3. If more than 24 hours elapse between the polyurethane foam application and the start of the silicone coating application, thoroughly inspect the polyurethane foam surface for UV degradation and oxidation. Primer application may be necessary to regain possible adhesion lost caused by UV deterioration. Call BASF technical department for procedures to proceed, if UV degradation has affected the SPF.
4. Make sure all environmental conditions of Section 1.06 are met prior to silicone coating application.

B. Application

1. The silicone base coat shall be applied on the same day as the polyurethane foam application, after the polyurethane foam has been allowed to cure a minimum of one hour. Apply the base coat in a uniform application to achieve a finished dry film thickness of approximately 10 mils required for the roof.
2. The base coat shall not be subjected to foot traffic or otherwise disturbed until it is tack-free or cured. After it has cured, inspect the coating for pinholes, cracks, thin areas or other defects. All defects observed shall be caulked with silicone sealant and/or roller coated with additional base coat prior to applying subsequent coats of silicone.
3. The base coat and sealant must be cured, clean and free of all moisture prior to application of topcoat.
4. Apply the topcoat in a contrasting color to the base coat within 72 hours of the base coat application. The topcoat application shall be made at right angles to the base coat application. Surface texture and conditions may require additional quantities of silicone to insure proper thickness. It is the applicator's responsibility to properly coat the insulation regardless of the quantity of silicone coating necessary.
5. Apply the topcoat in a uniform application to achieve a minimum total finished dry film thickness of the base coat and topcoat of 20 mils. It is the applicator's responsibility to ensure the minimum total dry film thickness specified is achieved throughout the entire roof area regardless of the quantity of silicone coating required.
6. The BASF SKYTITE® silicone Roof Coating shall be applied a minimum of 2 inches beyond all the terminated edges of the polyurethane foam. These terminations should be masked to provide a straight edge, neat, finished appearance.
7. Allow the topcoat to cure and inspect the finished coating surface for pinholes, cracks, thin areas, or other defects. Repair any defects observed with silicone sealant and/or additional silicone coating material.

3.5 GRANULE APPLICATION

A. Application

1. Apply roofing granules in the second finish coat of silicone coating. A minimum of 10 dry mils of silicone coating is required to hold the granules.
2. Apply the roofing granules, using suitable compressed air equipment, uniformly at a rate of approximately 40 pounds per 100 square feet of roof area.

3. Apply the roofing granules immediately after the additional coating application to obtain maximum wet-out and embedment.
4. After the coating has fully cured, excessive, loose granules shall be removed using a soft-bristled broom to prevent blocking drains, scuppers, or gutters.
5. Bare spots in the granulated surface shall be filled in by applying additional coating and granules in these areas.

3.6 FIELD QUALITY CONTROL

- A. The independent inspector shall instruct the contractor to repair any deficient roof areas, such as: ponding, wet insulation, deck problems, required new drains, etc.
- B. Core samples of the silicone coated polyurethane roof system will be secured at completion by an independent licensed inspection firm at a rate of one core per 10,000 square feet, with a minimum of 2 cores per roof, to test for SPF thickness, compressive strength, density and adhesion. Additionally, slit samples will be taken at a rate of 6 per 10,000 square feet, with a minimum of 6 per roof, to test the coating thickness and coating adhesion. Sampled areas will be repaired using silicone sealant and replacement SPF cores.
- C. Applicator's quality control during application shall consist of the following, as a minimum:

3.7 SAFETY REQUIREMENTS

- A. Proper safety precautions shall be followed throughout the entire roofing operation. OSHA and local regulations shall be strictly followed. Manufacturer's Material Safety Data Sheets must be available on site, for specific safety information on handling and working with all materials. Spray Polyurethane Foam Alliance and the American Chemistry Council's Recommendations for the Safe Handling and Use of Sprayed Urethane Foam and Coating Materials shall be strictly adhered to. Dispose of all trash, debris and empty containers in accordance with local regulations.
- B. On the roof and at all work sites, a properly maintained fire extinguisher will always be available.
- C. Dispose of trash, debris and empty containers in accordance with local regulations.
- D. Follow SPF guidelines found in www.spraypolyurethane.org
- E. All workers must have completion of H + S online course for SPF High Pressure Processing

3.8 FOLLOW-UP INSPECTIONS

- A. The system manufacturer shall have a standard warranty program, employing an independent testing firm to perform periodic inspections throughout the term of the warranty. Normal maintenance and repair inspections are to be completed by the owner or contracted for following BASF or NRCA SPF Maintenance and Inspections of SPF Roofing Systems.

END OF SECTION 07 55 23

SECTION 07 65 26 – SASM FLASHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. SASM through-wall, opening, penetration, and transition flashings that are not integral to WRB or AB installation.
 - 2. Installation materials.
 - 3. Surface preparation.
 - 4. Site tests and inspections.
 - 5. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. WRB: Weather-Resistive Barrier.
 - 2. VDR: Vapor Diffusion Retarder.
 - 3. AB: Air Barrier.
 - 4. SASM: Self-Adhering Sheet Membrane.
 - 5. UV: Ultraviolet Solar Radiation.
- B. Definitions:
 - 1. Manufacturer: Means the flashing manufacturer, unless otherwise indicated.
 - 2. Roof: Means the top cover of a building having a slope of 60 degrees or less from the zero-degree horizontal plane.
 - 3. Non-Roof: Means the top cover of a building having slope more than 60 degrees from the zero-degree horizontal plane.
 - 4. Wall: Means one of the sides of a room or building connecting a floor and ceiling or foundation and roof, and having slope less than 30 degrees from the 90-degree vertical plane.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Performance Requirements: SASM flashing membranes installed around the perimeter of exterior opening assemblies and other penetrations must conform to Level 3 (elevated temperature exposure) requirements of American Architectural Manufacturers Association publication AAMA 711, Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.
- B. Coordination: Verify chemical and adhesive compatibility of selected flashings with installed waterproofing, WRBs, ABs, VDRs, roofing, sealants, and other items with which the flashings are in direct contact, based on current product formulations.
- C. Preinstallation Meeting:

1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation
 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, or performance of installed WRBs. Resolve each condition.
 4. Finalize construction schedule.
 5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.
- D. Sequencing:
1. Install flashings only after penetrating items are installed.
 2. Install flashings only after openings are framed.
- E. Scheduling:
1. Installations Requiring Primer: Flashings must be applied within 24 hours of primer installation. Schedule installation to limit exposure of primed surfaces to not more than 24 hours. Re-prime surfaces exposed for more than 24 hours in conformance with manufacturer's instructions for re-priming.
 2. UV Exposure: Schedule installation to keep flashing exposure to UV within the manufacturer's recommended limits.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 2. Shop Drawings:
 - a. Submit dimensioned drawings showing joints, seams, tie-ins, and dimensions, including terminations, penetrations, coves, interior and exterior corner conditions, openings, penetrations, and expansion and drift joints.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
3. Manufacturer's Representative Reports:
 - a. Before beginning work, request and submit reports confirming substrates are properly prepared in conformance with manufacturer's instructions and other requirements and recommendations; are acceptable and satisfactory to receive the work of this specification section; and conform to all requirements necessary to issue specified and other warranties.
 - b. During the work, request and submit reports documenting actions taken by the manufacturer's representative to verify conformance with manufacturer's instructions and other requirements and recommendations.
 - c. Upon completion, request and submit reports confirming installed roofing conforms to all requirements necessary to issue specified and other warranties.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Flashings must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Flashings must be obtained only from a manufacturer that sends a representative to the project site before beginning work to verify existing conditions; and during work to perform manufacturer's field services.
3. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

B. Qualifications:

1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing flashings installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
2. Installer: Company or individuals must have at least 5 years' experience installing flashings for at least 30 previous projects similar to this project in size, material, design, and complexity.
3. Supervisors: Individuals must have at least 7 years' experience installing flashings for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading flashing installers.
4. Manufacturer's Representative: Individuals must have at least 5 years' technical field experience performing manufacturer's services for at least 50 previous projects similar to this project in size, material, design, and complexity.

- ### C. Mockups:
- If an ex-situ exterior wall integrated mockup is required for this project, then integrate flashing into the mockup as part of the work of this specification section.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage during storage.
 - 1. Prevent stored items from contacting the floor or ground and from deterioration and damage.
 - 2. Sheet products must be tightly rolled face out on a sturdy core designed for that purpose and vertically stored unless otherwise required or recommended by the manufacturer. Promptly remove and replace rolled sheet products that are flattened or distorted during shipping, unloading, or storage.
 - 3. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 - 4. Incline covered items to ensure maximum drainage of accumulated moisture.
 - 5. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage, including heat and sudden changes in temperature, and UV exposure beyond manufacturer- recommended limits.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install flashings only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
 - 1. Do not install flashings during rain or snow, fog or mist; or when rain or snow is predicted within 24 hours of installation.
 - 2. Proceed only when there is no threat of impending precipitation, and both current and forecasted weather conditions conform to those required, recommended, or accepted by the manufacturer.
- B. Existing Conditions: Surfaces to which flashings are installed must be dry. Install flashings only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.

- C. Other Conditions: Do not apply flashings where dust is generated, or liquids are sprayed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
1. Carlisle Coatings and Waterproofing Inc.
 2. GCP Applied Technologies.
 3. Henry Co.

2.2 THROUGH-WALL SASM FLASHING

- A. Standard Through-Wall Flashing:
1. Description: Self-adhering cross-laminated high-density polyethylene (HDPE) composite sheet/rubberized asphalt adhesive flashing membrane, with release liner on the adhesive side, conforming to AAMA 711 requirements for self-adhered flashing materials.
 2. Applications: Through-wall flashing for cavity wall applications.
 3. Products: "Perm-A-Barrier Wall Flashing" manufactured by GCP Applied Technologies, or equal.
 4. Requisite Properties:
 - a. Minimum Thickness: At least 40 mils.
 - b. Minimum Roll Width: At least 12 inches.
 - c. Maximum UV Exposure Limit: Not more than 45 days.
 - d. Color: Green with repeated logo imprint.
 5. Performance Requirements:
 - a. Maximum Water Vapor Transmission: Not more than 0.05-perm, when tested in conformance with ASTM E 96 method B.
 - b. Minimum Pull Adhesion to Concrete: At least 60 pounds per foot, when tested in conformance with ASTM D 903 modified.
 - c. Minimum Low Temperature Flexibility: Unaffected at minus 45 deg. F, when tested in conformance with ASTM D 1970.
 - d. Minimum Elongation: At least 200 percent, when tested in conformance with ASTM D 412 die C modified.
- B. Aluminum-Faced Detail Membrane:
1. Description: Aluminum-faced self-adhering cross-laminated high-density polyethylene (HDPE) composite sheet/rubberized asphalt adhesive, with release liner on the adhesive side, conforming to AAMA 711 requirements for self-adhered flashing materials.
 2. Applications: Detail membrane for air and vapor barrier applications.
 3. Restrictions: May not be used when aluminum facing might contact cementitious materials (e.g., Portland cement plaster) or dissimilar metals.
 4. Products: "Perm-A-Barrier Aluminum Flashing" manufactured by GCP Applied Technologies, or equal.
 5. Requisite Properties:
 - a. Minimum Thickness: At least 40 mils.
 - b. Minimum Roll Width: At least 9 inches.

- c. Maximum UV Exposure Limit: Not more than 270 days.
- d. Color: Natural finish aluminum.
- 6. Performance Requirements:
 - a. Maximum Water Absorption: Not more than 0.1 percent, when tested in conformance with ASTM D 570.
 - b. Minimum Puncture Resistance: At least 80 pounds, when tested in conformance with ASTM E 154.
 - c. Minimum Elongation: At least 200 percent, when tested in conformance with ASTM D 412 die C modified.

2.3 OPENING AND PENETRATION SASM FLASHING

A. Standard SASM Flashing:

- 1. Description: Self-adhering cross-laminated high-density polyethylene (HDPE) composite sheet/rubberized asphalt adhesive flashing membrane, with release liner on the adhesive side, conforming to AAMA 711 requirements for self-adhered flashing materials.
- 2. Applications: Deck-to-wall intersections, inside and outside corners of sheathing, wall-to-wall tie-ins, foundation sill plates, sheathing panel seams, and other non-roof detail areas.
- 3. Restrictions: May not be used
 - a. in hot desert areas in the southwestern United States;
 - b. in contact with with flexible PVC or vinyl windows; and
 - c. with certain metal windows having integral nail fins.
- 4. Products: "Vycor Plus" manufactured by GCP Applied Technologies, or equal.
- 5. Requisite Properties:
 - a. Minimum Thickness: At least 25 mils.
 - b. Minimum Roll Width: At least 9 inches.
 - c. Maximum UV Exposure Limit: Not more than 21 days.
 - d. Color: Black-gray.
- 6. Performance Requirements:
 - a. Maximum Water Vapor Transmission: Not more than 0.05-perm, when tested in conformance with ASTM E 96 method B.
 - b. Minimum Pull Adhesion to Plywood: At least 3 pounds per inch, when tested in conformance with ASTM D 903 modified.
 - c. Minimum Low Temperature Flexibility: Unaffected at minus 20 deg. F. , when tested in conformance with ASTM D 1970.
 - d. Minimum Elongation: At least 250 percent, when tested in conformance with ASTM D 412 die C modified.

B. Aluminum-Faced SASM Flashing:

- 1. Description: Aluminum surfaced self-adhering cross-laminated high-density polyethylene (HDPE) composite sheet/rubberized asphalt adhesive, with release liner on the adhesive side, conforming to AAMA 711 requirements for self-adhered flashing materials.
- 2. Applications: Deck-to-wall intersections, inside and outside corners of sheathing, wall-to-wall tie-ins, foundation sill plates, sheathing panel seams, and other non-roof detail areas.
- 3. Restrictions: May not be used

- a. in hot desert areas in the southwestern United States;
 - b. in contact with flexible PVC or vinyl windows;
 - c. with certain metal windows having integral nail fins; and
 - d. when aluminum facing may contact cementitious materials (e.g., Portland cement plaster) or dissimilar metals.
 - 4. Products: “Vycor Aluminum Flashing” manufactured by GCP Applied Technologies, or equal.
 - 5. Requisite Properties:
 - a. Minimum Thickness: At least 25 mils.
 - b. Minimum Roll Width: At least 6 inches.
 - c. Maximum UV Exposure Limit: Not more than 350 days.
 - d. Color: Natural finish aluminum.
- C. Butyl SASM Flashing:
- 1. Description: Self-adhering cross-laminated polypropylene sheet/non-asphaltic butyl adhesive flashing membrane, with release liner on the adhesive side, conforming to AAMA 711 Level 3 requirements for elevated exposure self-adhered flashing materials. Asphaltic adhesive flashing membranes are prohibited.
 - 2. Applications: Used for flashing around window and door headers, sills, jambs, thresholds, and nailing flanges; and under exterior plaster (stucco) trims.
 - 3. Products: “Vycor PRO” manufactured by GCP Applied Technologies, or equal.
 - 4. Requisite Properties:
 - a. Minimum Thickness: At least 14 mils.
 - b. Minimum Roll Width: At least 9 inches.
 - c. Maximum UV Exposure Limit: Not more than 100 days.
 - d. Color: White with green paint.

2.4 INSTALLATION MATERIALS

- A. Liquid Flashing:
- 1. Description: Trowel grade, asphalt modified urethane.
 - 2. Application: Used as repair material for defects on concrete surfaces; as fillet and reinforcement material at inside corners; as flashing material at outside corners and around drains, protrusions, curbs and parapets; and as sealing material at membrane terminations.
 - 3. Product: “Bituthene Liquid Membrane” manufactured by GCP Applied Technologies, or equal.
- B. Green Concrete Primer:
- 1. Description: Low-VOC solvent-based primer.
 - 2. Applications: Used to prime green concrete cured less than 7 days; and to prime damp concrete, masonry, sheathing or wood surfaces to which SASMs are applied.
 - 3. Product: “Bituthene Primer B2 LVC” manufactured by GCP Applied Technologies, or equal.
- C. Sheathing Primer:
- 1. Description: Water-based primer.
 - 2. Application: Used to prime fiber cement and GMF gypsum sheathing.

3. Product: “Perm-A-Barrier WB Primer” manufactured by GCP Applied Technologies, or equal.

2.5 ACCESSORIES:

- A. Sealant:
 1. Description: Silicone sealant conforming to ASTM C 920 requirements for Type S, Grade NS, Class 25.
 2. Product: “758” manufactured by Dow Corning Corp., or equal.
 3. Color: White.
- B. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify that in-place construction conforms to the manufacturer’s requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed items.
- C. Evaluation and Assessment:
 1. Identify project conditions that do not conform to the manufacturer’s instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION:

- A. Substrate Preparation:
 1. Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
 2. Remove substrate coatings and other substances that may negatively affect the quality of the installation, durability, or performance of furnished flashings.
 3. Remove substrate ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with leveling and patching compound. Apply, trowel, and float patching compound to achieve smooth, flat, hard surface.

3.3 INSTALLATION

- A. Substrate Preparation:
 - 1. Install flashings using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Only install flashings under conditions that ensure they are free from blemishes and defects.
 - 3. Completed work must match approved samples and mockups, as accepted by the Architect.
 - 4. Installed flashings must be warrantable. Do not install, correct, or replace flashings in a manner that results in any warranty or guarantee becoming void.
- B. Substrate Preparation:
 - 1. Accurately align flashing membranes and maintain uniform side and end laps at least 3 inches or as specifically depicted in the project details. Apply flashing membranes with side laps shingled in the direction of bulk water flow.
 - 2. Clean seam areas, overlap flashing membranes, and roll side and end laps in conformance with the flashing manufacturer's installation instructions to ensure a watertight seam installation.
 - 3. Press and form material tightly against the substrate.
 - a. Pressure is essential to eliminate wrinkles and bubbles.
 - b. Ensure complete and continuous adhesion by using a hard neoprene or stainless steel hand roller.
 - c. Apply sealant or liquid membrane at flashing membrane leading edges.
 - 4. Install flashing around windows in the following order.
 - a. Install in conformance with details indicated on Drawings.
 - b. Ensure complete and continuous adhesion by using a hard neoprene or stainless steel hand roller.
 - b. Install in conformance with the flashing membrane manufacturer, and the door and window manufacturers' installation instructions.
 - c. Install in conformance with ASTM E 2112. Apply sealant or liquid membrane at flashing membrane leading edges.
 - 5. Install flashing under copings over wall flashing, WRBs, and roof membranes.
 - a. Provide aluminum-faced flashing separation at incompatible materials.
 - b. Lap joints at least 3 inches.
 - c. Hand-roll seams for complete adherence to substrate.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach flashing to supporting construction.

3.4 FIELD QUALITY CONTROL

- A. Site Tests and Inspections:
 - 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - a. Schedule and arrange all tests and inspections.
 - b. Coordinate all work and the final construction schedule with all tests and inspections.
 - c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.

- d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site tests and inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
2. Adhesion Testing: Before beginning work in each area, conduct adhesion tests with manufacturer's representative present at start of installation over each new substrate.
- B. Manufacturer Services: Installed work is subject to examination by the manufacturer's representative to determine conformance to manufacturer's instructions and other requirements and recommendations.
- 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - 2. Itemize into a punch list all noted items and record the manufacturer's requirements and recommendations for correcting each punch list item.
 - 3. Promptly bring all punch list items into conformance with the manufacturer's requirements and recommendations until accepted in writing by the Architect.
 - 4. Manufacturer's representative withholds issuing warranties until all punch list items are accepted by the Architect.

3.5 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- 1. Repair punctures, tears, voids, and deficient lapped seams that do not conform to specified requirements. Slit and flatten fishmouths and blisters.
 - 2. Extend patches 6 inches beyond repaired areas in all directions. Seal edges with sealant or liquid membrane.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
- 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.6 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.7 PROTECTION

- A. Protect installed flashings in place from prolonged exposure to UV manufacturer's recommended limits, exposure to weather, becoming wet, contact with damp or wet surfaces, and other sources of deterioration, and damage until covering flashings. If exposed to UV for more than the recommended limit, then flashings must be removed and replaced in conformance with the manufacturer's instructions.
- B. Do not store anything on, adjacent to, or against installed flashings unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed flashings as work surfaces.
- C. Remove protection when it's no longer needed and before covering.

END OF SECTION 07 65 26

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop- or field-fabricated flashings used for roofing and flashing applications.
 - 2. Delegated design of flashing assemblies.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 05 50 00 for dissimilar metal corrosion protection.

1.2 REFERENCES

- A. Include Abbreviations and Acronyms:
 - 1. BMT: Base Metal Thickness.msg
 - 2. HDG: Hot-Dip Galvanized.
 - 3. MSG: Manufacturer's Standard Gage for Sheet Steel.
 - 4. USSG: United States Standard Gage for Sheet.
 - 5. NRCA: National Roofing Contractors Association.
 - 6. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
- B. Definitions:
 - 1. Fabricator: Means the decorative flashing fabricator, unless otherwise indicated.
 - 2. Manufacturers' Standard Gage for Sheet Metal: Means the thickness steel sheet based on a weight of 41.82 pounds per square foot per inch of thickness.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate installation of roof perimeter flashings with installation of roof drainage system.
 - 2. Coordinate installation of counterflashing with installation of base flashings.
 - 3. Coordinate installation of roof-penetration flashings with installation of roofing and other items penetrating roof.
 - 4. Coordinate the installation of equipment support flashings with the installation of roofing and equipment.
 - 5. Coordinate the installation of wall flashings with the installation of wall-opening components, including windows, doors, and louvers.
- B. Delegated Design Requirements:
 - 1. Engineer, fabricate, assemble, and install flashings that conform to the profiles indicated and other Contract Document requirements; meet specified performance criteria; and results in structurally sound, non-corroding, and weathertight assemblies that

- accommodate, resist, distribute, or transfer in-service loads without incipient or catastrophic failure.
2. Maintain visual design concept indicated, including sizes, profiles, and alignments. Deviation from visual design concept is non-conforming work and prohibited without prior written acceptance by the Architect
- C. Performance Requirements:
1. Design Pressure: Calculate in conformance with American Society of Civil Engineers/ Structural Engineering Institute publication ASCE/SEI 7, “*Minimum Design Loads and Associated Criteria for Buildings and other Structures*”..
 2. Design Wind Rating:
 - a. Minimum Roof Field Area: 60 pounds per square foot.
 - b. Roof Perimeter Area: 90 pounds per square foot.
 - c. Roof Corner Area: 120 pounds per square foot.
 3. Design Negative Uplift Pressure: Coping system must conform to FMG requirements for at least a Class I-90 wind uplift rating.
 4. Thermal Expansion and Contraction: Accommodate movement resulting from at least 120 deg. F ambient and 180 deg. F material surface temperature differentials (changes).
 5. Dissimilar Metal Corrosion Protection: Permanently isolate metal surfaces from direct contact with incompatible materials and other potentially corrosive substrates.
- D. Performance Requirements:
1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation
 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed flashings. Resolve each condition.
 4. Finalize construction schedule.
 5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Product Data:
 - a. For manufactured items, submit manufacturer’s product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing flashing layout and types. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing profiles, shapes, joints, seams, and dimensions, including coves, miters, and corner conditions. Cross-reference details to plans and elevations.
 - c. Indicate method of attaching, fastening, joining, adhering, and anchoring to adjacent construction.

- d. Show backings, embedments, fasteners, brackets, clips, cleats, straps, mounting devices, and other attachments.
 - e. Label each attachment type; indicate manufacturer's product name for each manufactured item.
 - f. Indicate base material and finish, fastener material and finish, and material and finish of items being fastened or attached.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
- 1. Delegated Design Submittals: Together with shop drawings, submit engineering calculations demonstrating conformance to the Contract Documents and all impacts of delegated design scope of work on other work.
 - a. Calculations must be explicit and legible and must incorporate distinct cross-references to submitted shop drawings in sufficient quantity to render the calculations readily intelligible and reviewable.
 - b. At a minimum, calculations must include design loads; analysis of supporting construction, including section-property computations; analysis of fasteners, anchors, attachments, and connectors; and signature and seal of the licensed professional engineer responsible for preparing them.
 - c. Test reports are not an acceptable substitute for calculations and are returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

- A. Quality Standard Requirements:
- 1. Design Standard: Comply with SMACNA publication "*Architectural Sheet Metal Manual*" requirements for design dimensions, geometry, metal thickness and other characteristics, and installation of flashings.
 - 2. Installation Standard: Comply with NRCA publication "*Roofing and Waterproofing Manual*", Volume 2, "*Architectural Sheet Metal and Metal Roofing*" requirements for the design and installation of sheet metal flashing and trim items installed as part of roofing applications.
- B. Qualifications:
- 1. Fabricator: Company or individuals must have at least 10 years' experience fabricating flashings installed on at least 100 previous projects similar to this project in size, material, design, and complexity
 - 2. Installer: Company or individuals must have at least 5 years' experience installing flashings for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - 3. Supervisors: Individuals must have at least 7 years' experience installing flashings for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading flashing installers.
 - 4. Engineer: Must be a licensed professional structural engineer registered to practice in Massachusetts having at least 10 years' experience performing the kind of engineering

services indicated for at least 20 previous projects similar to this project in size, material, design, and complexity.

- C. Mockups: If an ex-situ exterior wall integrated mockup is required for this project, then integrate flashing into the mockup as part of the work of this specification section.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped. Furnish adequate dunnage and bracing during storage.
 - 1. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage.
 - 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 - 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 - 4. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage.
- C. Handling: Handle items in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective flashings with undamaged new flashings that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot-Dip Galvanized and Galvannealed Steel Sheet: ASTM A 653, CS Type B (commercial steel), with equal coating weight on each surface, coating weight designation (mass designation) indicated below on both surfaces.
 - 1. Natural Finish (Galvanized): Provide material with at least a G90 coating weight, regular spangle, chemically treated (desired for humid-storage stain resistance; can still be painted; recommended for sheet that will be used unpainted), and oiled (intended as a corrosion inhibitor; sheet must be thoroughly cleaned to remove the oil prior to painting).

2. Shop-Painted Finish (Galvanized): Provide material with at least a G90 coating weight, minimized spangle, chemically treated (desired for humid-storage stain resistance; can still be painted; recommended for sheet that will be used unpainted), and oiled (for enhanced formability; sheet must be thoroughly cleaned to remove the oil prior to painting).
 3. Field-Painted Finish (Galvannealed): Provide material with at least an A60 coating weight, not chemically treated, not oiled, and mill phosphatized (paint-grip finish; provides enhanced lubricating characteristics).
- B. Stainless Steel Sheet:
1. Exposed Locations: ASTM A 666 (annealed and tempered), Type 304L (for welded applications) or Type 304 (for all other applications), annealed, No. 2 (half hard) temper (hardness between Rockwell B-65 and B-70; can be bent 90 degrees across the direction of rolling around a radius equal to its thickness), passivated in conformance with ASTM A 967.
 - a. Natural Finish: Furnish materials having a No. 2B (bright) finish.
 - b. Painted Finish: Furnish materials having a No. 2D (matte) finish.
 2. Concealed Locations: ASTM A 240 (annealed) Type 304L (for welded applications) or Type 304 (for all other applications), annealed, No. 2 (half hard) temper (hardness between Rockwell B-65 and B-70; can be bent 90 degrees across the direction of rolling around a radius equal to its thickness), passivated in conformance with ASTM A 967.
 3. Natural Finish: Furnish materials having a No. 4 (bright) finish.
- C. Aluminum Sheet: ASTM B 209, 5005-H32 (for anodic finishing) and 3003-H14 (for painted or unfinished sheet).
- D. Storage: Pre-Painted Coated Coil and Sheet: ASTM A 755.
1. Sheet: Aluminum sheet.
 2. Top Side Finish: 70-percent by weight liquid polyvinylidene fluoride (PVDF) coating system conforming to AAMA 2605 and consisting of a prime coat applied to a DFT of at least 0.2-mil and either a solid color coat applied to a DFT of at least 0.75-mil; or a metallic color coat applied to a DFT of at least 0.75-mil and a clear topcoat applied to a DFT of at least 0.50-mil, as indicated on the Drawings or selected by the Architect.
 3. Reverse Side Finish: 0.25-mil DFT acrylic bottom side primer and polyester wash coat (backer coat).
- E. Lead and Lead Alloy Strip, Sheet, and Plate: Lead sheet conforming to ASTM B 749 and Federal Specification (FS) QQ-L-201f requirements for the following.
1. Applications (including laboratories and shops): Grade B (99.50 percent lead content).
 2. High Purity Applications: Grade B (99.50 percent lead content)
 3. High Purity and Structural Strength Applications: Grade D (99.85 percent lead content).
- F. Lead-Coated Copper Strip and Sheet: ASTM B 101.

2.2 ROOFING INSULATION AND COVER BOARD

- A. Description:
1. Gutters: Fabricate from at least 0.0359-inch BMT (MSG 20) hot-dip galvanized and galvannealed steel sheet.

2. Downspouts: Fabricate from at least 0.0359-inch BMT (MSG 20) hot-dip galvanized and galvanized steel sheet.
- B. Requisite Properties:
1. Profiles, Edge Styles, and Attachments: Indicated on the Drawings.
 2. Joint Style: J2. (butt and backup plate)
 3. Fabrication: Provide standard profiles from the SMACNA quality standard publication, Chapter 1.
 - a. Fabricate in sections between 8-and 10-feet long,
 - b. Fabricate backup plates from the same material and thickness as copings.
 - c. Miter corners, seal, mechanically fasten, and solder or weld watertight.
 - d. All corners and transitions must be shop or factory fabricated. Corner pieces shall extend minimum 12 inches beyond corner in both directions.
 - e. Only linear transitions may be field fabricated.
 - f. Finish: Filed-applied duplex coating.

2.3 OTHER SHEET METAL FLASHINGS AND TRIM

- A. Description:
1. Through-Wall Flashings: Fabricate from at least 0.0250-inch thick (USSG 24) stainless steel sheet.
 2. Opening Flashings in Framed Construction: Fabricate from at least 0.0359-inch BMT (MSG 20) hot-dip galvanized and galvanized steel sheet.
 3. Elevator Hoistway Guards: Fabricate from at least 0.0359-inch BMT (MSG 20) hot- dip galvanized and galvanized steel sheet.
 4. Flashings and Trim in Contact with Aluminum Components: Fabricate from at least 0.032-inch aluminum sheet.
 5. Flashings and Trim in Contact with Concrete, Gravel, or Soil and Elsewhere Indicated: Fabricate from at least 26-ga. stainless steel Type 316 sheet.
 6. Other Flashings and Trim: Unless otherwise noted, fabricate from at least 0.0299- inch BMT (MSG 22) hot-dip galvanized and galvanized steel sheet; or from at least 0.0250-inch (USSG 24) Type 316 stainless steel sheet.

2.4 ACCESSORIES:

- A. Splash Pans: Standard precast concrete units cast from at least 4,000 pounds per square inch concrete. Precast units must have rounded corners and smooth and dense surfaces free of honeycombs.
- B. Soldering Materials:
1. HDG Sheet Metal Solder and Flux: 50-percent tin solder conforming to ASTM B 32 Grade Sn50 and used with raw muriatic acid flux.
 2. Stainless Steel Sheet Metal Solder and Flux: 60-percent tin solder conforming to ASTM B 32 Grade Sn60 and used with an acid-type flux supplied, required, or recommended by stainless-steel sheet manufacturer.
 3. Copper Sheet Metal Solder and Flux: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead and non-corrosive soldering salt flux for uncoated copper; rosin flux for tin, lead and tinned copper.

- C. Fasteners: Provide fasteners and accessory materials suitable to the type of use and conditions of installation and service indicated; and as required for producing secure attachment to supporting construction without staining or deterioration of either the base materials or fastened materials; or deterioration of the fastener itself when in contact with base materials or fastened materials.
1. Pop rivet attachment is prohibited.
 2. Provide fasteners are made of the same material as the fastened material or have a suitable barrier protection coating.
 - a. Apply corrosion-inhibiting material (e.g., pastes, washers, compounds, etc.) under the heads of screws or bolts inserted into dissimilar metal, even if they are already treated or have a protective coating.
 - b. Washers, gaskets, and sleeves must be made of plastic or closed-cell polychloroprene (Neoprene).
 3. Verify fasteners and accessories that are galvanically compatible with fastened materials under conditions of installation and service, as demonstrated by the fastener manufacturer based on testing and field experience. Do not use fasteners that are corrosive or otherwise incompatible with fastened materials.
 4. Where fasteners are subject to loosening or turning out due to thermal and structural movements, wind loads, vibration, and other causes, provide self-locking devices that either maintain tension in the fastener assembly or remain locked even if tension in the assembly is lost. (e.g. washers, locknuts, and similar items)
 5. Exposed fasteners are prohibited on faces exposed to view. Provide concealed fasteners and expansion provisions. Where unavoidable, provide flat head cap screws (type FHCS) with drive slots filled and finished flush and smooth with adjacent surfaces.
- D. Underlayment:
1. Description: Self-adhering cross-laminated high-density polyethylene (HDPE) composite sheet/non-asphaltic butyl adhesive flashing membrane, with release liner on the adhesive side. Asphaltic adhesive flashing membranes are prohibited.
 2. Product: “Grace Ultra” manufactured by GCP Applied Technologies, or equal.
 3. Requisite Properties:
 - a. Minimum Thickness: At least 30 mils.
 - b. Minimum Roll Width: 36 inches.
 - c. Maximum UV Exposure Limit: Not more than 100 days.
 - d. Maximum High Temperature Application: Up to 300 deg F.
- E. Sealant:
1. Exposed Sealant: “756 SMS” neutral-curing silicone sealant manufactured by Dow Corning Corp., or equal conforming to ASTM C 920.
 2. Concealed Sealant: Single-component, solvent-release plasticized polyisobutylene (butyl rubber) conforming to ASTM C 1311; black color.
 3. Sheet Metal Lap Sealant: “Sikaflex 15LM” low-modulus urethane sealant manufactured by Sika Corp., or equal.
 4. Color: Selected by the Architect from the manufacturer’s standard colors.
- F. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2-inch wide and 1/8-inch thick.
- G. Bituminous Coating: Cold-applied asphalt emulsion conforming to ASTM D 1187.

- H. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.5 FABRICATION

- A. Shop Fabrication:
 - 1. Before beginning fabrication, apply strippable film or other temporary protection normally furnished or necessary to protect metal from deterioration and damage during fabrication.
 - 2. Fabricate items in largest sections practicable to minimize field jointing.
 - 3. Fabricate flashing in thickness or weight needed to conform to the specified performance requirements, but not less than indicated for each application and metal.
 - 4. Fabricate exposed work precise, straight, and true to line, size, and shape; plumb, level, and square within allowable tolerances; and with accurate angles and surfaces, and crisp straight edges.
 - 5. Fabricate flashing without excessive oil canning, buckling, and tool marks; precise, straight, and true to line, size, shape, and levels indicated; with accurate angles and straight edges; and with exposed edges folded back to form hems.
 - 6. Fabricate exposed connections with flush hairline joints, and square and true edges and corners.
 - 7. Inside and outside corners, and changes in direction, must be fabricated watertight assemblies with mechanically-fastened and continuously welded or soldered joints.
 - 8. Form non-expansion, but movable, joints in metal to accommodate sealant. Where lapped expansion provisions cannot be used, form expansion joints with at least one-inch deep intermeshing hooked flange; fill with butyl sealant concealed within joints.
 - a. Exposed fasteners are prohibited on faces exposed to view.
 - b. Provide concealed fasteners and expansion provisions elsewhere.
 - 9. Fabricate cleats and attachment devices from the same material as the item being anchored, of sizes as recommended by the SMACNA quality standard publication for the application, but not less than thickness of metal being secured
 - 10. Do not use graphite pencils to mark metal surfaces.
- B. Fabrication Tolerances: Fabricated items must conform to the following; specified tolerances are non-cumulative.
 - 1. Maximum Offset between Components at Joints: 1/8-inch except that at welded joints, offset are not allowed.
 - 2. Maximum Deviation from Slope and Location Lines: 1/4-inch in 20 feet.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.

- B. Verification: Verify that in-place construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION:

- A. General Requirements:
 - 1. Scribe and cope items as necessary for an accurate fit. Perform required cutting, drilling, and fitting for flashing installation.
 - 2. Set flashings true to line, to required levels and lines, plumb, square, and cut and fitted without warp or rack; sloped or level as required; with flush well-fitted joints; and in alignment with adjacent construction.
 - 3. Shim as required with concealed shims.
 - 4. Install exposed flashings without excessive oil canning, buckling, and tool marks. Do not use graphite pencils to mark metal surfaces.
 - 5. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 6. Fit exposed connections accurately to form flush hairline joints. Trim to fit substrates and to result in watertight performance. Torch cutting is prohibited.
 - 7. Set sheet metal in bed of urethane sealant over concrete surfaces or coat with bituminous coating where compatible with overlying materials to prevent galvanic corrosion.
 - 8. Install sealant tape where indicated.
- B. Expansion Provisions: Provide provisions for thermal expansion.
 - 1. Space movement joints not more than 10 feet on center. Joints may not be located within 24 inches of corners or intersections.
 - 2. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints with intermeshing hooked flanges at least one inch deep, and fill with sealant concealed within the joints.
 - 3. At exposed sheet metal fabrications, provide 8 in. wide splice plates. Set sheet metal laps in low-modulus urethane sealant. At sheet metal backing, provide 8-inch wide splice plates or at least 4-inch laps set in bed of low-modulus urethane sealant between pieces of sheet metal. Do not apply sealant to surface of joints.
- C. Seal joints where indicated on the Drawings and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members at least one inch into the sealant. Form joints to completely conceal sealant.
 - 2. When ambient temperature at the time of installation is between 40 and 70 deg. F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg. F.
 - 3. Prepare joints and apply sealants in conformance with Section 07 92 00.

D. Soldered Joints:

1. Soldered joints must also be mechanically fastened
2. Clean surfaces to be soldered.
3. Pre-tin sheet edges to at least 1-1/2 inches from the edge; reduce pre-tinning area where the pre-tinned surface might show in the completed work.
4. Promptly remove acid flux residue from metal after tinning and soldering. Clean and neutralize in conformance with the solder manufacturer's installation instructions.
5. Do not use torches for soldering.
6. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

E. Special Techniques:

1. Roof Drainage System: Install sheet metal roof drainage components as indicated to produce a complete roof drainage system conforming to the referenced standard.
2. Roof Flashing: Install sheet metal flashing and trim in conformance with specified performance requirements, the SMACNA quality standard publication requirements. Provide concealed fasteners where possible, set units true to line, and level. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
3. Roof Edge Flashing: Anchor to resist uplift and outward forces in conformance with the SMACNA quality standard publication and recommendations. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
4. Copings: Anchor to resist uplift and outward forces in conformance with the SMACNA quality standard publication requirements and recommendations and roofing requirements.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to the supporting substrate at not more than 24-inches on center.
 - b. Anchor the interior leg of copings with washers and screw fasteners through slotted holes at not more than 24 inches on center.
5. Pipe and Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
6. Counterflashing: Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant.
7. Roof-Penetration Flashing: Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof. All penetrations must receive umbrella flashings.
8. Wall Flashing: Install sheet metal wall flashing as indicated, and to intercept and exclude penetrating moisture in conformance with the referenced standard's recommendations.
9. Opening Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend beyond wall openings as indicated on the shop drawings.
10. Miscellaneous Flashing:
 - a. Equipment Support Flashing: Weld or seal flashing with elastomeric sealant to equipment support members.
 - b. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated. Pipe and install drain lines to plumbing waste or drainage system as indicated on the plumbing drawings.

- F. Interface with Adjacent Items:
 - 1. Provide materials, components, and accessories normally furnished or necessary to securely attach flashing to supporting construction.
 - 2. Provide provisions for thermal and structural movement.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with at least 2 fasteners. Bend tabs over fasteners.
- G. Installation Tolerances: Shim and align flashing within an installed tolerance of 1/4-inch in 20 feet on slope and location lines indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: After installation, correction, and repair are complete, remove strippable film or other temporary protection. Promptly remove from exposed metal surfaces anything that might interfere with uniform oxidation or weathering.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

- C. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed flashing in place from deterioration and damage until Substantial Completion.
- B. Do not store anything on, adjacent to, or against installed flashings unless they are protected from damage. Do not use installed flashings as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 07 62 00

SECTION 07 84 00 – FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Through-penetration firestop systems.
 - 2. Fire-resistive joint systems (fire calks).
 - 3. Perimeter fire-resistive joint systems (fire safing).
 - 4. Surface preparation.
 - 5. Installation materials.
 - 6. Site tests and inspections.
 - 7. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 09 81 33 for firestop putty pads.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. UL: Underwriter's Laboratories.
- B. Definitions:
 - 1. Manufacturer: Means the firestopping manufacturer, unless otherwise indicated.
 - 2. Fire Partition Means construction designed and tested to resist the passage of fire for a prescribed time, specifically at fire barriers, fire walls, shafts, exit enclosures, smoke barriers, corridor construction and other construction assemblies.
 - 3. L-Rating: Means the amount of air or cold smoke that can leak through a penetration, when tested in conformance with UL 1479.
 - 4. F-Rating: Means the time a penetration firestop system prevents the passage of fire through a penetration, when tested in conformance with ASTM E 814 or UL 1479.
 - 5. T-Rating: Means the time a firestop system, including the penetrating item, limits the maximum temperature rise to 325 deg. F above its initial temperature through the penetration on the non-fire side, when tested in conformance with ASTM E 814 or UL 1479.
 - 6. Assembly Rating: Means the combination of T- and F-ratings in an assembly, with F equaling T, when tested in conformance with ASTM E 1966 or UL 2079.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Assisted by the selected manufacturer, choose firestopping components, products, and materials that correspond to selected firestopping systems shown by reference designations to

- a. Underwriters Laboratories, as listed in UL publication, “Fire Resistance Directory”.
 - b. Intertek’s ETL SEMKO Division, as listed in its Omega Point Laboratories publication, “*Directory of Listed Building Products, Materials, & Assemblies*”.
 2. Where modifications to tested assemblies are necessary to suit project conditions or address applications for which there are no tested systems, obtain engineering judgments from the firestopping manufacturer derived from similar qualified tested system designs and other testing.
 - a. Submit engineering judgments for review and approval and obtain written acceptance of modifications prior to submitting shop drawings to the Architect.
 - b. Engineering judgment documents must conform to International Firestop Council for Evaluating Firestop Systems Engineering Judgments requirements.
 3. Coordinate openings and penetrating items to ensure installed firestopping conforms to specified requirements and the selected firestop system testing laboratory designation.
 - a. Coordinate sizing of sleeves, openings, core-drilled holes, and cut openings to accommodate firestop systems in conformance with the manufacturer’s requirements and recommendations.
 - b. Provide exposed firestopping material colors selected by the Architect from the standard color range currently available from the manufacturer. Custom colors are prohibited.
- B. Acoustical Requirements: Provide non-hardening resilient firestop material at penetrations, sleeves, and passsthroughs in acoustic construction assemblies.
- C. Sequencing: After firestopping installation, maintain ambient conditions within a range required, recommended, approved, or accepted by the manufacturer until Final Completion.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Product Data: Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 2. Shop Drawings: Submit project-specific key plans showing firestopping installations.
 3. Firestopping Schedule: Submit firestopping schedule indicating firestopping types, laboratory tested assembly numbers, protected elements including sizes, materials, and minimum hourly fire-resistance rating for each fireproofed item. Cross-reference firestopping schedule to key plans.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer’s Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer’s instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer’s representative and obtain project-specific supplemental instructions printed on manufacturer’s letterhead.

- b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Firestopping must be obtained through one source from the same manufacturer (to ensure compatibility and a uniform appearance).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

B. Qualifications:

1. Installer: Company or individuals must have at least 5 years' experience installing firestopping for at least 30 previous projects similar to this project in size, material, design, and complexity. Installers and supervisors must be
 - a. authorized, certified, licensed, or otherwise qualified by the manufacturer for at least the past 5 consecutive years as having the necessary experience, personnel, and training to install or apply the manufacturer's products, including all related components and accessories; and
 - b. approved by FM Approvals in conformance with FMG publication Class Number 4991, "Approval Standard for Approval of Firestop Contractors" or qualified by UL in conformance with its "Qualified Firestop Contractor Programs".
 - c. Only personnel trained and certified by the manufacturer in the proper installation or application techniques may supervise or perform any of the work of this specification section.
2. Supervisors: Individuals must have at least 7 years' experience installing firestopping for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading firestopping installers.

C. Field Samples: Include in-situ mockups as part of the work of this specification section.

1. The Architect reviews field samples for conformance to the Contract Documents and approves or rejects them as the standard by which subsequent work is evaluated.
2. Revise field samples and repeat reviews, including arranging all revisions and paying all revision costs, until accepted in writing by the Architect. Final acceptance of firestopping is made from field samples.
3. After acceptance, promptly identify and protect field samples for reference until Substantial Completion.
4. Approved field samples may remain part of the work after being identified for future reference.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage during storage.
 - 1. Prevent stored items from contacting the floor or ground and from deterioration and damage.
 - 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 - 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 - 4. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage, including heat and sudden changes in temperature, and UV exposure beyond manufacturer- recommended limits.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
 - 1. Avoid damage to packaging and containers, and contamination of contents.
 - 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install flashings only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
 - 1. Do not install firestopping during rain or snow, fog or mist; or when rain or snow is predicted within 24 hours of installation.
 - 2. Proceed only when there is no threat of impending precipitation, and both current and forecasted weather conditions conform to those required, recommended, or accepted by the manufacturer.
 - 3. Do not apply firestopping when
 - a. ambient temperature is below 45 deg. F or more than 90 deg. F during application, and for at least 8 hours after;
 - b. surface temperatures are less than 40 deg. F or greater than 120 deg. F; and
 - c. surface temperatures are 5 deg. F or less above the dew point.

- B. Existing Conditions:
1. Surface Conditions: Surfaces receiving firestopping must be dry. Install firestopping only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 2. Ventilation: Maintain adequate ventilation during and after installation and curing, setting, or drying. Where natural ventilation is inadequate, use forced-air circulation or mechanical ventilation as necessary for the installations indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
1. 3M Fire Protection Products.
 2. Hilti, Inc.
 3. Specified Technologies, Inc.

2.2 FIRESTOPPING ASSEMBLIES

- A. Description:
1. Through-Penetration Firestop Systems: Provide firestop systems tested and identified in UL's "Fire Resistance Directory" product Category XHEZ, or equal.
 2. Fire-Resistive Joint Systems (fire calks): Provide firestop systems tested and identified in UL's "Fire Resistance Directory" product Category XHBN, or equal.
 3. Perimeter Fire-Resistive Joint Systems (safing insulation): Provide firestop systems tested and identified in UL's "Fire Resistance Directory" product Category XHDG, or equal.
- B. Requisite Properties:
1. F-Rated Firestop Systems: Provide firestop systems in fire partitions having an F rating that meets or exceeds the fire-resistance rating of the penetrated construction, but not less than one-hour.
 2. T-Rated Firestop Systems: In fire-resistive floor-ceiling or roof-ceiling construction, or other constructions where penetrating items pass through occupied areas and may contact combustible materials, provide firestop systems having both an F- and a T-rating, determined in conformance with ASTM E 814 or UL 1479. T-rated assemblies are required where the following conditions exist with exceptions.
 - a. Where firestop systems protect floor penetrations located outside of wall cavities.
 - b. Where firestop systems protect floor penetrations located outside fire-resistive shaft enclosures.
 - c. Where firestop systems protect penetrations located in fire-resistive construction containing doors required to have a temperature-rise rating.
 - d. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 square inches in overall cross-sectional area.
 3. L-Rated Firestop Systems: Where firestop systems are indicated in smoke barriers and elsewhere, provide penetration firestop systems with an L-rating of not more than 5.0 cubic feet per minute per square foot both at ambient temperatures and at 400 deg. F.

4. Firestopping Exposed to Traffic, Moisture, or Physical Damage: Provide products that do not deteriorate after curing.
5. Plumbing and Wet-Pipe Sprinkler System Piping Penetrations: Provide moisture-resistant penetration firestop systems.
6. Penetrations with Insulated Piping: Provide penetration firestop systems that do not require piping insulation removal.
7. Floor penetrations with Annular Spaces Exceeding 4 inches Wide and Exposed to Possible Loading and Traffic: Provide firestop systems that support floor loads involved, either by installing floor plates or by other means.
8. Surface-Burning Characteristics: Provide firestopping having a maximum FSI Value of 0 and a maximum SDI Value of 0 (Class A), when tested in conformance with ASTM E 84.

2.3 MATERIALS

- A. Latex Sealant: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- B. Silicone Sealant: Single-component, silicone-based, neutral-curing elastomeric sealants. Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces; non-sag formulation for openings in walls and other vertical and overhead surfaces.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.
- D. Intumescent Putty: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Intumescent Blocks: Intumescent flexible block based on a two-component polyurethane foam
- G. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- H. Pillows and Bags: Reusable heat-expanding pillows and bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- I. Pre-formed Mineral Wool: Designed to fit flutes of metal decking and the gap between the top of wall and metal decking as a backer for spray material.
- J. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors, consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket, including similar devices.

- K. Pre-Installed Firestop Devices: Factory-assembled devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and cable bundles penetrating concrete floors or gypsum board walls.
- L. Metal Track Firestopping:
 - 1. Description: Top- and bottom-of-wall metal tracks to fills gaps between the metal and concrete surfaces and help seal out fire and smoke sound drafts.
 - 2. Product: “Firestop Top Track Seal CFS-TTS” manufactured by Hilti, or equal.
- M. Fire Rated Cable Pathways:
 - 1. Description: Gangable device modules consisting of steel raceways with intumescent foam pads requiring no additional action to achieve fire and leakage ratings, including plugs, twisting closure, putty, pillow, or sealant.
 - 2. Products: “EZ-PATH Series 44+ Fire Rated Pathway” manufactured by Specified Technologies, Inc., or equal.
 - 3. Requisite Properties:
 - a. Size: 4 inches wide by 4-5/8 inches high by 14 inches long.
 - b. Material: 0.059-inch BMT (MSG 18) galvanized steel sheet.

2.4 ACCESSORIES

- A. Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.5 MIXING

- A. Open firestopping containers only as required for use and mix only in designated areas.
- B. Thoroughly agitate and stir materials to a uniform and smooth consistency suitable for proper installation.
- C. Do not reduce, alter, or introduce foreign materials into firestopping, except in conformance with manufacturer’s instructions and other requirements and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer’s instructions and other requirements and recommendations.

2. Verify substrates are dry and free of deleterious and other substances that might interfere with firestopping adhesion, appearance, or performance.
- C. Evaluation and Assessment:
1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION:

- A. A. Protection:
1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and firestopping installation.
 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.

3.3 INSTALLATION

- A. General Requirements:
1. Install firestopping using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 2. Only install firestopping under conditions that ensure finishes are free from blemishes and defects.
 3. Provide smooth surfaces of uniform finish, color, appearance, and coverage. Fireproofing surfaces with cloudiness, spotting, holidays, runs, or other imperfections are prohibited and are rejected as non-conforming work.
 4. Do not exceed the application rates recommended by the manufacturer.
 5. Completed work must match approved samples and mockups, as accepted by the Architect.
 6. Installed firestopping must be warrantable. Do not install, correct, or replace firestopping in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
1. Prime substrates as required, recommended, approved, or accepted by the manufacturer, using the manufacturer's recommended products and methods.
 - a. Confine primers to bond areas.
 - b. Do not allow spillage and migration onto exposed surfaces
 2. Install forming, damming, and backing materials and other accessories as required to support fill materials during installation in the positions needed to produce cross-sectional shapes and depths required for indicated fire ratings.
 3. Verify wet film thickness of firestopping during application by taking numerous measurements with a wet film gage.
 4. After installing fill materials and allowing them to fully cure, remove forming materials and other accessories not indicated as permanent components of the firestopping systems.

- a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required achieving fire-resistance ratings indicated.
- b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
- c. Where fill materials remain exposed after installation, produce uniform finished surfaces without substrates, undercoats, marks, or stains showing through. Produce sharp and even lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Site Inspections:

- 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - a. Schedule and arrange all tests and inspections.
 - b. Coordinate all work and the final construction schedule with all tests and inspections.
 - c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.
 - d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site tests and inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
- 2. Required Inspections: Inspections are performed in conformance with the requirements of ASTM E 2174 (through penetration fire stops) and ASTM E 2393 (fire resistive joint systems and perimeter fire barriers).

3.5 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and

3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.6 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.7 PROTECTION

- A. Protect installed firestopping in place from deterioration and damage until covering firestopping or Substantial Completion.
- B. Do not store anything adjacent to or against installed firestopping unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed firestopping surfaces as work surfaces.
- C. Remove protection when it's no longer needed and before covering firestopping or Substantial Completion.

END OF SECTION 07 84 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Traffic sealants.
 - 2. Exterior façade sealants.
 - 3. Interior joint sealants.
 - 4. Joint sealant backings.
 - 5. Surface preparation.
 - 6. Site tests and inspections.
 - 7. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 08 81 00 for structural silicone sealants for glazing applications.
 - 2. Section 09 81 33 for acoustical sealants.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. UL: Underwriter's Laboratories.
- B. Definitions:
 - 1. Manufacturer: Means the sealant manufacturer, unless otherwise indicated.
 - 2. Ultra-Low Modulus: Means having a joint movement extension/compression capability of at least a 100-percent increase and at least a 50-percent decrease, when tested in conformance with ASTM C 719.
 - 3. Low Modulus: Means having a joint movement extension/compression capability of at least a 50-percent increase and at least a 50-percent decrease, when tested in conformance with ASTM C 719.
 - 4. Medium Modulus: Means having a joint movement extension/compression capability of at least a 35-percent increase and at least a 35-percent decrease, when tested in conformance with ASTM C 719.
 - 5. High Modulus: Means having a joint movement extension/compression capability of at least a 25-percent increase and at least a 25-percent decrease, when tested in conformance with ASTM C 719.
 - 6. Very High Modulus: Means having a joint movement extension/compression capability of at least a 12.5-percent increase and at least a 12.5-percent decrease, when tested in conformance with ASTM C 719.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Proposed substitution requests and submittals that change the quality (grade) or generic chemistry of specified sealants are prohibited and returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
- B. Acoustical Requirements: Provide non-hardening resilient firestop material at penetrations, sleeves, and passthroughs in acoustic construction assemblies.
1. Joint sealants must establish and maintain a continuous watertight seal without staining substrates or deterioration.
 2. Sealants installed in contact with porous substrates must demonstrate testing in conformance with ASTM C 1248 resulting in no staining to porous materials identical to those indicated for this project.
- C. Preinstallation Meeting:
1. Hold a meeting after preliminary preparation of specified submittals and before issuing submittals to the Architect for review and approval.
 - a. Sealant manufacturer's representative and distributor must attend meeting.
 - b. Sealant installer and the same installer's personnel designated to perform the work of this specification section must attend meeting.
 - c. Architect and waterproofing consultant must attend meeting.
 2. During the meeting, review the Contract Documents, preliminary submittals, in-service project conditions, and installation sequence and methods, including special details and conditions that might affect installation.
 - a. Review, discuss, and schedule preconstruction testing to determine chemical and adhesive compatibility of all materials, joint substrates, shims, setting blocks, joint sealant backings, secondary seals, and other materials that will contact or affect joint sealants. Obtain joint-sealant manufacturer's instructions for corrective measures for items failing tests.
 - b. Review and discuss sealant backings, including backing types, materials, configurations, sizes, installed depths relative to joint widths, and other criteria.
 - c. Review and discuss substrate preparation, including whether priming and other specific joint preparation techniques are necessary or required to obtain optimum adhesion of joint sealants to joint substrates.
 - d. Review and discuss sealant mixing, installation, and tooling, including joint configurations relative to ASTM C 1193 and those indicated on the Drawings.
 - e. Review and discuss field testing, including both non-destructive and destructive testing procedures, subsequent evaluation and corrective measures for items failing tests, and repair of damaged sealants.
 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed sealants. Resolve each condition.
 4. Finalize construction schedule.
 5. Record significant discussions and distribute meeting minutes. Do not make submittal to the Architect for review and approval until disagreements are successfully resolved to the satisfaction of all parties.
- D. Scheduling: Schedule cleaning to prevent dust and other contaminants from falling on freshly-applied sealants.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - a. Submit manufacturer's product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
 - 2. Samples: Submit at least 6-inch long representative samples of each sealant variety in each selected color.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
 - 1. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Joint sealants must be obtained through one source from the same manufacturer (to ensure compatibility and a uniform appearance).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

- B. Qualifications:
1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing sealants installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
 2. Installer: Company or individuals must have at least 5 years' experience installing joint sealants for at least 30 previous projects similar to this project in size, material, design, and complexity. Installers and supervisors must be
 3. Supervisors: Individuals must have at least 7 years' experience installing joint sealants for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading joint sealant installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage during storage.
1. Prevent stored items from contacting the floor or ground and from deterioration and damage.
 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 4. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage, including heat and sudden changes in temperature, and UV exposure beyond manufacturer- recommended limits.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
1. Avoid damage to packaging and containers, and contamination of contents.
 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install joint sealants only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
 - 1. Do not install joint sealants during rain or snow, fog or mist; or when rain or snow is predicted within 24 hours of installation.
 - 2. Proceed only when there is no threat of impending precipitation, and both current and forecasted weather conditions conform to those required, recommended, or accepted by the manufacturer.
 - 3. Do not apply firestopping when
 - a. ambient temperature is below 45 deg. F or more than 90 deg. F during application, and for at least 8 hours after; ambient temperature is below 45 deg. F or more than 90 deg. F during application, and for at least 8 hours after;
 - b. surface temperatures are less than 40 deg. F or greater than 120 deg. F; and
 - c. surface temperatures are 5 deg. F or less above the dew point.
- B. Existing Conditions:
 - 1. Surface Conditions: Surfaces receiving firestopping must be dry. Install firestopping only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 - 2. Ventilation: Maintain adequate ventilation during and after installation and curing, setting, or drying. Where natural ventilation is inadequate, use forced-air circulation or mechanical ventilation as necessary for the installations indicated.
- C. Other Conditions: Do not apply sealants where dust is generated, or liquids are sprayed.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 5 years (urethane sealants) and 20 years (silicone sealants).
- B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Silicone Sealant Manufacturers: Provide products manufactured by one of the following, or equal. Private label and third-party-manufactured sealants are prohibited.
 - 1. Dow Corning Corp.
 - 2. Momentive Performance Materials, Inc.
- B. Polyurethane Sealant Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. BASF Building Systems.

2. Pecora Corp.
 3. Sika Corp.
- C. Manufacturers: Provide products manufactured by one of the following, or equal Acrylic Latex Sealant Manufacturers.
1. LATICRETE International, Inc.
 2. Pecora Corp.
 3. Tremco, Inc.

2.2 TRAFFIC JOINT SEALANTS

- A. Self-Leveling Polyurethane Traffic Sealant:
1. Application: Used to weather seal interior and exterior flat walkways, plazas, decks, parking garages, and similar horizontal installation joints subject to pedestrian or vehicular traffic.
 2. Description: Single-component polyurethane sealant conforming to ASTM C 920 requirements for Type S, Grade P, Class 25, Use T, M or O sealant, as applicable.
 3. Product: Provide one of the following, or equal.
 - a. “Sonneborn Sonolastic SL 1” manufactured by BASF Building Systems.
 - b. “Urexpam NR-201” manufactured by Pecora Corp.
 - c. “Sikaflex-1c SL” manufactured by Sika Corp.
 4. Colors: Selected by the Architect from the manufacturer’s standard colors.
- B. Non-Sag Polyurethane Traffic Sealant:
1. Application: Used to weather seal interior and exterior sloped walkways, plazas, decks, parking garages, and similar sloped installation joints subject to pedestrian or vehicular traffic.
 2. Description: 2-component polyurethane sealant conforming to ASTM C 920 requirements for Type M, Grade NS, Class 25, Use T, NT, M, G, A, O, or I sealant, as applicable.
 3. Product: “Sikaflex-2c NS” manufactured by Sika Corp., or equal.
 4. Colors: ProductOptions indicated on the Drawings or selected by the Architect.

2.3 EXTERIOR FACADE SEALANTS

- A. Ultra-Low Modulus Silicone Sealant:
1. Description: Neutral-curing silicone sealant conforming to ASTM C 920 requirements for Type S, Grade NS, Class 100/50, Use NT, A or O sealant, as applicable.
 2. Application: Used for sealing expansion and control joints, precast concrete panel joints, EIFS joints, curtainwall joints, mullion joints, stone pavers, and other exterior building joints subject to extreme or dynamic movement.
 3. Products: Provide one of the following, or equal.
 - a. “DOWSIL 790” manufactured by Dow Corning Corp.
 - b. “GE SCS 2700 SilPruf LM” manufactured by Momentive Performance Materials, Inc.
 4. Colors: Selected by the Architect from the manufacturer’s standard colors.

B. Low Modulus Silicone Sealant:

1. Description: Neutral-curing silicone sealant conforming to ASTM C 920 requirements for Type S, Grade NS, Class 50, Use NT, M, G, A or O sealant, as applicable.
2. Application: Used for weatherproofing building facade materials, including glass, aluminum, steel, painted metal, EIFS, granite and other stone, concrete, brick and plastics.
3. Products: Provide one of the following, or equal.
 - a. “DOWSIL 795” manufactured by Dow Corning Corp.
 - b. “GE SCS 2000 SilPruf LM” manufactured by Momentive Performance Materials, Inc.
4. Colors: Selected by the Architect from the manufacturer’s standard colors.

C. Butyl Sealant:

1. Description: Single-component, solvent-release plasticized polyisobutylene (butyl rubber) conforming to ASTM C 1311.
2. Application: Applied to weather seal joints between sheet metal flashings and substrates.
3. Color: Black.
4. Description: Top- and bottom-of-wall metal tracks to fills gaps between the metal and concrete surfaces and help seal out fire and smoke sound drafts.
5. Product: “Firestop Top Track Seal CFS-TTS” manufactured by Hilti, or equal.

2.4 SPECIALTY JOINT SEALANTS

A. Low Modulus Porous Surface Sealant:

1. Description: Neutral-curing silicone sealant conforming to ASTM C 920 for Type S, Grade NS, Class 50, Use NT, M, G, A or O sealant, as applicable.
2. Application: Used for weatherproofing exterior building joints in sensitive porous stone requiring reduced substrate staining; and with metal panel substrates requiring reduced residue rundown.
3. Products: Provide one of the following, or equal.
 - a. “756 SMS” manufactured by Dow Corning Corp.
 - b. “GE SCS 9000 SilPruf NB” manufactured by Momentive Performance Materials, Inc.
4. Colors: Selected by the Architect from the manufacturer’s standard colors.

2.5 INTERIOR JOINT SEALANTS

A. Single-Component Damp Location Sealant:

1. Description: Medium or high modulus mildew-resistant silicone sealant conforming to ASTM C 920 requirements for Type S, Grade NS, Class 25, Use NT, A or O sealant, as applicable.
2. Products: Provide one of the following, or equal.
 - a. “786” manufactured by Dow Corning Corp.
 - b. “Sanitary SCS 1700” manufactured by Momentive Performance Materials, Inc.
3. Colors: White or clear, as selected by the Architect.

- B. General Purpose Interior Sealant:
1. Description: Siliconized acrylic-latex sealant conforming to ASTM C 834 requirements for Type OP, Grade NF classification, as required.
 2. Products: Provide one of the following, or equal.
 - a. “AC-20+Silicone” manufactured by Pecora Corp.
 - b. “Tremflex 834” manufactured by Tremco, Inc.
 3. Colors: Selected by the Architect from the manufacturer’s standard colors.

2.6 JOINT SEALANT BACKINGS

- A. Closed Cell Foam Joint Backing:
1. Description: Extruded polyethylene foam cylindrical sealant backings conforming to ASTM C 1330, Type C.
 2. Application: Provide closed-cell backer rod at all exterior applications unless otherwise indicated on the Drawings.
 3. Products: Provide one of the following, or equal.
 - a. “Mile High Foam” manufactured by Backer Rod Mfg. Inc.
 - b. “HBR” or “Green Rod” manufactured by Nomaco, Inc.
 - c. “NuFlex 870” manufactured by TVM Building Products.
 4. Performance Requirements:
 - a. Maximum Water Absorption: Not more than 0.10 grams per cubic centiliter when tested in conformance with conformance with ASTM C 1016, Procedure B.
 - b. Minimum Density: At least 24 per cubic meter when tested in conformance with conformance with ASTM D 1622.
 - c. Maximum Outgassing: Less than 1 bubble when tested in conformance with conformance with ASTM D 1253.
 - d. Minimum Compression Recovery: At least 90 percent, when tested in conformance with conformance with ASTM D 5249.
 - e. Minimum Compression Deflection: At least 20.5 percent, when tested in conformance with conformance with ASTM D 5249.
 - f. Minimum Tensile Strength: At least 200 kPa, when tested in conformance with conformance with ASTM D 1623.
- B. Open Cell Foam Joint Backing:
1. Restrictions: Permitted only for interior use, and as the second (interior) line of a double-line sealant application.
- C. Bi-Cellular (Dual-Cell) Foam Joint Backings:
1. Description: Extruded polyethylene foam cylindrical sealant backings conforming to ASTM C 1330, Type B.
 2. Restrictions: Permitted only for interior use. Only bi-cellular (dual-cell) foam may be used as a backing for single-component (air-cure) materials.
 3. Products: “Sof Rod” or “Dual Rod” manufactured by Nomaco, Inc., or equal.
 4. Performance Requirements:
 - a. Maximum Water Absorption: Not more than 0.10 grams per cubic centiliter when tested in conformance with conformance with ASTM C 1016, Procedure B.
 - b. Density: At least 24 kilograms per cubic meter when tested in conformance with conformance with ASTM D 1622.

- c. Maximum Outgassing: Less than 1 bubble when tested in conformance with conformance with ASTM D 1253.
 - d. Minimum Compression Recovery: At least 90 percent, when tested in conformance with conformance with ASTM D 5249.
 - e. Minimum Compression Deflection: At least 20.5 percent, when tested in conformance with conformance with ASTM D 5249.
 - f. Minimum Tensile Strength: At least 200 kPa, when tested in conformance with conformance with ASTM D 1623.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.
- E. Prefabricated Backer Seal: “BackerSeal” manufactured by Emseal Joint Systems, Ltd., or equal.

2.7 TAPE SEALANTS

- A. Foam Tape:
- 1. Description: Closed-cell, compressible PVC foam with pressure-sensitive adhesive.
 - 2. Product: “NORSEAL” foam tape manufactured by Saint-Gobain Performance Plastics, or equal.
- B. Primer and Surface Cleaners:
- 1. Application: Applied to enhance and strengthen sealant adhesion to porous and nonporous substrates; and help ensure proper joint preparation
 - 2. Porous and Cementitious Surfaces: “1200 OS Primer” manufactured by Dow Corning Corp., or equal.
 - 3. Other Surfaces: “Construction Primer P” manufactured by Dow Corning Corp., or equal.

2.8 ACCESSORIES

- A. Primer and Surface Cleaners:
- 1. Application: Applied to enhance and strengthen sealant adhesion to porous and nonporous substrates; and help ensure proper joint preparation
 - 2. Porous and Cementitious Surfaces: “1200 OS Primer” manufactured by Dow Corning Corp., or equal.
 - 3. Other Surfaces: “Construction Primer P” manufactured by Dow Corning Corp., or equal.
- B. Masking Tape: Provide paper masking tape manufactured by 3M, or equal, unless another kind is supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project
- C. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.9 MIXING

- A. Open sealants containers only as required for use and mix only in designated areas.
- B. Do not reduce, alter, or introduce foreign materials into sealants, except in conformance with manufacturer's instructions and other requirements and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Verify joint dimensions and joint backer sizes conform to width-to-depth ratios, neck dimensions, and surface bond areas required, recommended, or accepted by the manufacturer.
 - 3. Verify substrates are dry and free of deleterious and other substances that might interfere with firestopping adhesion, appearance, or performance.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION:

- A. Protection:
 - 1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and joint sealant installation.
 - 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
- B. Substrate Preparation:
 - 1. Prepare substrates in conformance with ASTM C 1193 and as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
 - 2. Remove loose materials and foreign matter that may impair sealant adhesion.

3. Clean and prime substrates as required, recommended, or accepted by the manufacturer, using the manufacturer's recommended products and methods.
 - a. Confine primers to bond areas.
 - b. Do not allow spillage and migration onto exposed surfaces

3.3 INSTALLATION

A. General Requirements:

1. Install joint sealants in conformance with ASTM C 1193 using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
2. Only install joint sealants under conditions that ensure finishes are free from blemishes and defects.
3. Provide smooth surfaces of uniform finish, color, appearance, and coverage. Joint sealant surfaces with cloudiness, spotting, holidays, runs, or other imperfections are prohibited and are rejected as non-conforming work. Produce sharp and even lines and color breaks.
4. Completed work must match approved samples and mockups, as accepted by the Architect.
5. Installed joint sealants must be warrantable. Do not install, correct, or replace joint sealants in a manner that results in any warranty or guarantee becoming void.

B. Special Techniques:

1. Install sealant backings to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Install sealants free of air pockets, foreign embedded matter, ridges, and sags.
 - b. Do not leave gaps between ends of sealant backings.
 - c. Do not stretch, twist, puncture, or tear sealant backings.
 - d. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
2. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
3. Size materials to achieve required width/depth ratio.
4. Install sealants using proven techniques that conform to the following and at the same time backings are installed:
 - a. Place sealants so they directly contact and fully wet joint substrates.
 - b. Completely fill recesses in each joint configuration.
 - c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - d. Employ installation techniques that ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.
 - e. Joint configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.
 - f. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.
5. Promptly after sealant application, and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - a. Remove excess sealant from surfaces adjacent to joints.

- b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - d. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 - e. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
6. Preformed Silicone-Sealant System:
- a. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 - b. Apply silicone sealant to each side of joint to produce a bead of size conforming to the preformed silicone-sealant system manufacturer's instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 - c. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 - d. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
7. Preformed Foam Sealant Special Techniques:
- a. Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material.
 - b. Produce seal continuity at ends, turns, and intersections of joints.
 - c. For applications at low ambient temperatures, apply heat to sealant in conformance with sealant manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

- A. Site Tests and Inspections:
- 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - a. Schedule and arrange all inspections.
 - b. Coordinate all work and the final construction schedule with all inspections.
 - c. Coordinate inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.
 - d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
 - 2. Porous Substrate Stain Testing: Procedures must conform to ASTM C 510.
 - 3. Non-Destructive Spot Testing: Procedures must conform to ASTM C 1521.

- a. The center of sealant beads is depressed with a blunt dowel-shaped probing tool to depth of 50 percent of the bead width.
 - b. If sealant fails, then the failure is recorded along with whether the failure was an adhesive or cohesive failure, and the maximum surface depression as a percentage of joint width.
 - c. Tests are performed every 12 inches for first 10 linear feet of each joint; if test failure is not observed, then tests are performed every 24 inches thereafter.
- 4. Non-Destructive Continuous Inspection: Procedures must conform to ASTM C 1521.
 - a. Certain sealant quantities, locations, and lengths up to 100-percent inspection of an entire assembly sealant may be chosen by the Architect for general sealant assessment, including joint configurations known to be difficult to install, changes in sealant and substrate types, or other quantities and locations.
- 5. Destructive Testing: Procedures must conform to ASTM C 1521.
 - a. Neatly cut out and remove failed sealant, prepare and prime surfaces, and install new sealant.
 - b. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

3.5 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.6 CLEANING

- A. Cleaning Work: Clean sealant from adjacent surfaces.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.

4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

END OF SECTION 07 92 00

SECTION 07 92 01 – JOINT SEALANTS FOR SKATEPARKS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. General: construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1.2 RELATED SECTIONS:

- A. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE FOR SKATEPARKS
- B. SECTION 03 37 13 – SHOTCRETE FOR SKATEPARKS
- C. SECTION 03 40 00 – PRECAST CONCRETE FOR SKATEPARKS

PART 2 – PRODUCTS

- A. Expansion and isolation joint filler strips: expansion joint materials shall be flexible polyethylene closed cell foam or similar and supplied by concrete contractor. Deck-o-foam or equivalent.
- B. Expansion joint sealant: sikaflex - 1a ns tg polyurethane elastomeric sealant, or approved equal. Color of caulk should resemble natural color of concrete (aluminum gray or limestone).
- C. Saw cut joint sealant: sikaflex-1c sl high performance, self- leveling, 1-part polyurethane sealant, or approved equal. Color of caulk should resemble natural color of concrete (aluminum gray or limestone)

PART 3 - EXECUTION

3.1 CONCRETE:

- A. Expansion joints: form expansion joints of specified joint-filler strips where indicated
 - 1. Locate expansion joints as indicated on drawings.
 - 2. Extend joint fillers full width and depth of joint.
- B. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half dowel length to prevent concrete bonding to one side of joint.
 - A. Speed dowels, or approved equal, are acceptable for slip dowels
- C. Control joints: form weakened-plane joints, sectioning concrete into areas as indicated. Construct control joints for a depth as indicated in the drawings (generally 1/4 of the pavement thickness), as follows:

1. Sawed joints: form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface an before developing random contraction cracks. Early saw cuts are approximately 1 inch deep, regardless of pavement thickness. Refer to control joint guide drawing of plan set if applicable.
 2. If skatepark project design utilizes poured steps, control joints must be cut 3 - 4 feet from the edge of the top step.
- D. All joints created by the placement of concrete adjacent to previously cast concrete is the responsibility of the party placing the abutting concrete.
- E. Post cure detail work (as needed): grind smooth any inconsistencies in the finish or high spots between pours.

END OF SECTION 07 92 01

SECTION 08 12 13 – STANDARD HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal door frames.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 08 71 00 for door hardware.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. BMT: Base Metal Thickness.
 - 2. DHI: Door Hardware Institute.
 - 3. HM: Hollow Metal.
 - 4. MSG: Manufacturer's Standard Gage.
 - 5. DI: Steel Door Institute.
- B. Definitions:
 - 1. Manufacturer: Means the door frame manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate building opening tolerances with door frame manufacturing and erection tolerances.
 - 2. Coordinate hardware preparations, handing, and reinforcement requirements and locations with the Drawings, door schedule, and selected hardware sets.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Door Schedule: Submit schedule showing opening identification symbols and door and frame types and sizes, including thickness, swing, fire-resistance rating label

- requirements, undercuts, and finishes. Use the same reference numbers for openings and details as the Drawings.
3. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to door schedule.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Door frames must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Quality Standard Requirements:
1. Manufacturing Tolerances: Comply with the requirements of ANSI/SDI publication ANSI/SDI A250.8, "Recommended Specifications for Standard Steel Doors and Frames".
 2. Door Frame Installation Standards:
 - a. Install fire-resistance rated frames in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives".
 - b. Install other frames in conformance with of ANSI A250.11, "Recommended Erection Instructions for Steel Frames".
 3. Hardware Preparations and Reinforcement: Comply with the requirements of ANSI/SDI A250.6, "Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames" with reinforcing plates fabricated from the same material as door face sheets.
 4. Door Hardware Installation Standards: Install door frame hardware in conformance with ANSI/DHI A115-IG, "Installation Guide for Doors and Hardware".
- C. Qualifications:
1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing door frames installed on at least 200 previous projects similar to this

project in size, material, design, and complexity. Manufacturer must be a current member of SDI.

2. Installer: Company or individuals must have at least 5 years' experience installing door frames for at least 30 previous projects similar to this project in size, material, design, and complexity. Installer must be a current member of SDI.
3. Supervisors: Individuals must have at least 7 years' experience installing door frames for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading door frame installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
 3. Across the bottom of welded frames, at least 2 removable spreader bars must be tack welded to jambs and mullions.
 4. Frames must be palletized, wrapped, or crated to provide protection during transit and site storage.
- B. Storage: Store unloaded items as shipped, upright, and indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
- C. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- D. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 1. Allegion PLC.
 2. ASSA ABLOY.
 3. Door Components, Inc.
 4. MPI Custom Steel Doors and Frames.
 5. Republic Doors and Frames.
 6. Tremco, Inc.

2.2 STANDARD HOLLOW METAL FRAMES

- A. Description: 3-sided (open), fully welded masonry (universal) and flush drywall standard HM frames conforming to the requirements of Steel Door Institute publication SDI-100, “Recommended Specifications for Standard Steel Doors and Frames”.
- B. Products: “Steelcraft” frames manufactured by Allegion, or equal.
 - 1. Single Egress Door HM Frames: “F-Series” frames, or equal.
 - 2. Double Egress Door HM Frames: “FE-Series” frames, or equal.
 - 3. Cross-Corridor Door HM Frames: “DE-Series” frames, or equal.
 - 4. Stainless Steel HM Frames: “FS-Series” frames, or equal.

2.3 COMPONENTS

- A. Materials:
 - 1. Frames with an Uncoated Finish (Bare or Natural Finish): Fabricate from zinc coated (HDG) steel sheet or from stainless steel sheet, as indicated.
 - 2. Exterior Frames with a Painted Finish and Interior Frames Installed in Wet or High Humidity Locations (including shower rooms and toilet rooms): May be fabricated from either zinc-iron alloy coated (galvannealed) steel sheet or stainless steel sheet.
 - 3. Interior Frames Installed Elsewhere: Fabricate from uncoated CRS sheet.
 - 4. Sidelight and Transom Frames: Fabricate from the same material, thickness, and finish as the adjacent door frame.
- B. Material Thickness:
 - 1. HM Frames for Level 1 and Physical Performance Level C (Standard Duty) Doors: Fabricate from at least 0.0478-inch BMT (MSG 18) uncoated and zinc-coated steel sheet; or from at least 0.0500-inch (USSG 18) stainless steel sheet.
 - 2. HM Frames for Level 2 (Heavy Duty) and Physical Performance Level B: Fabricate from at least 0.0598-inch BMT (MSG 16) uncoated steel and zinc-coated steel BMT; or from at least 0.0625-inch BMT (USSG 16) stainless steel sheet.
 - 3. HM Frames for Level 3 and Physical Performance Level A (Extra Heavy Duty) Doors: Fabricate from at least 0.0598-inch BMT (MSG 16) uncoated steel and zinc-coated steel BMT; or from at least 0.0625-inch BMT (USSG 16) stainless steel sheet.
 - 4. HM Frames for Level 4 and Physical Performance Level A (Maximum Duty) Doors: Fabricate from at least 0.0747-inch BMT (MSG 14) uncoated and zinc-coated steel sheet, or at least 0.0781-inch (USSG 14) stainless steel sheet.
 - 5. Other HM Frames: Fabricate from at least 0.0598-inch BMT (MSG 16) uncoated steel and zinc-coated steel BMT; or from at least 0.0625-inch BMT (USSG 16) stainless steel sheet.
- C. Profiles:
 - 1. Types: Indicated on the Drawings.
 - 2. Throat Openings:
 - a. Butted Frames: Equal to the wall or partition type thickness minus twice the frame return dimension, unless otherwise indicated.
 - b. Wrap-Around Frames: Equal to the wall or partition thickness, unless otherwise indicated.
 - 3. Frame Depth:

- a. Butted Frames: Equal to the wall or partition thickness.
 - b. Wrap-Around Frames: Equal to the throat opening plus twice the frame return dimension.
 4. Frame Return Dimension: 1/2-inch.
 5. Backbend Dimension (Second, Double, or Drywall Return Dimension): At least 3/8-inch.
 6. Backbend Type: Indicated on the Drawings.
 7. Face Dimension: Provide 4-inch face dimension at heads in CMU construction where required to maintain a masonry module; provide 2-inch face dimension at jambs. Provide 2-inch face dimension elsewhere, unless otherwise indicated.
 8. Stop Dimension: 5/8-inch.
 9. Rabbet Depth Dimension: Equal to 3/16-inch greater than the door thickness.
 10. Opposite Door Rabbet Depth Dimension: 1-9/16 inches.
 11. Soffit Dimension: Equal to the frame depth minus the sum of the rabbet dimensions.
- D. Corners:
1. Welded HM Door Frames: Provide square-cut mitered or coped and mitered, set-up arc welded (SUA) and ground smooth, full profile welded frames (fully welded or continuously welded frames) for installation of frames as a complete unit. All corners must be watertight.
 2. HM Frame Glazing Beads: Provide butted corners.
- E. Hardware Preparations and Reinforcement: Provide HM frame hardware reinforcing and preparations in conformance with ANSI/SDI publications A250.6, "Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames" and A250.8,

2.4 ACCESSORIES

- A. Head Reinforcement: For opening widths greater than 48 inches wide, provide channel or angle stiffeners fabricated from at least 0.0747-inch BMT (MSG 14) zinc coated (HDG) steel sheet or at least 0.0781-inch BMT (USSG 14) stainless steel sheet, as applicable.
- B. Anchors:
1. Masonry Anchors: Provide either 3/16-inch minimum diameter (SWG 7) galvanized carbon steel masonry wire anchors or at least 0.0598-inch BMT (MSG 16) zinc coated (HDG) steel sheet masonry tee anchors, as applicable.
 2. Existing Opening Anchors: Provide at least 16-gage welded pipe sleeve anchors with 0.0598-inch BMT (MSG 16) zinc coated (HDG) steel sheet straps designed specifically to add support for bolting frames into rough openings of an existing walls.
 3. Wood Stud Anchors: Provide either at least 0.0598-inch BMT (MSG 16) zinc coated (HDG) steel sheet anchors designed specifically for attachment to the wood studs of a rough opening.
 4. Metal Stud Anchors: Provide either at least 0.0598-inch BMT (MSG 16) zinc coated (HDG) steel sheet anchors designed specifically for attachment to the webbing of the closed steel studs built around the frame.
 5. Universal Stud Wall Anchors: Provide either at least 0.0598-inch BMT (MSG 16) zinc coated (HDG) steel sheet universal lock-in jamb anchors designed specifically for use in either wood or steel stud wall applications, as applicable.

6. Base Anchors: Provide either at least 0.0598-inch (MSG 16) BMT zinc coated (HDG) steel sheet or at least 0.0625-inch BMT (USSG 16) stainless steel sheet base anchors, as applicable. Provide adjustable base anchors that allow for installation adjustment when the floor is not level.
- C. Electrical Device Requirements: Make provisions for installation of electrified hardware and door electrical devices, and arrange so that wiring is readily installed, removed, and replaced.
 1. Provide cutouts and reinforcement required for installation of devices.
 2. Provide metal conduits or raceways to accommodate wiring between devices. (e.g., from electric hinge to other electric door hardware)
- D. Glazing Stops:
 1. Fire-Rated Conditions: Provide 3/4-inch square channel glazing beads.
 2. Elsewhere: Provide 5/8-inch square channel glazing beads.
 3. Material Thickness: Fabricate from at least 0.0478-inch BMT (MSG 18) uncoated and zinc-coated steel sheet.
- E. Silencers: Provide loose, 1/8-inch thick by 1/2-inch wide pressure-sensitive-adhesive- backed polychloroprene (Neoprene) or ethylene propylene diene monomer (EPDM) rubber silencers for field installation. Furnish at least 3 for each strike jamb and at least 2 for double door head. Do not provide silencers where they may interfere with other seals, including smoke & draft seals.
- F. Filler: Provide material conforming to the requirements of ANSI/SDI publication A250.8, "Recommended Specifications for Standard Steel Doors and Frames". Use UL-listed materials in frames scheduled as having a fire-resistance rating.
- G. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.5 MATERIALS

- A. Uncoated Carbon Steel Sheet:
 1. Frame Material: Finished CRS coil, sheet, and strip conforming to ASTM A 1008, CS Type B (commercial steel), exposed, temper rolled, regular matte surface finish (40 to 59 AA), and oiled (sheet must be thoroughly cleaned to remove the oil prior to painting).
 2. Hardware Reinforcements: HRS coil, sheet, and strip conforming to ASTM A 1011, CS Type B (commercial steel), as-rolled surface finish, with cut edges.
- B. Zinc-Iron Alloy Coated (Galvannealed) Steel Sheet: ASTM A 653, CS Type B (commercial steel), with equal coating weight on each surface.
 1. Coating Weight (Mass) Designation: Provide at least a A60 (galvannealed) minimum coating weight (mass) designation.
 2. Surface Finish: Non-spangled matte finish.
 3. Surface Treatment: Provide mill phosphate surface treatment (paint-grip finish - provides enhanced lubricating characteristics).

- C. Zinc Coated (HDG) Steel Sheet: ASTM A 653, CS Type B (commercial steel), with equal coating weight on each surface.
 - 1. Coating Weight (Mass) Designation: Provide at least a G90 (galvanized) minimum coating weight (mass) designation.
 - 2. Surface Finish: Provide regular spangle surface finish.
 - 3. Surface Treatment:
 - a. Exterior Frames: Provide oil over chemical surface treatment (chemical treatment desired for humid-storage stain resistance and oil treatment needed for enhanced formability).
 - b. Interior Frames: Provide oiled surface treatment (needed for enhanced formability).

2.6 FINISHES

- A. Uncoated Steel HM Frames: Provide shop-applied phosphate (paint-grip) pre-treatment and baked on rust inhibitive primer. Primer must be compatible with either field-applied paint or field-applied coating systems specified in Division 09, as applicable.
- B. Zinc Coated and Zinc-Iron Alloy Coated Steel and Stainless Steel HM Frames: Provide shop-applied bonderized pre-treatment. (not prime painted)

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install door frames in conformance with the quality standards publications using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.

2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
3. Perform drilling and fitting as required or necessary for an accurate fit and complete installation.
4. Installed door frames must be warrantable. Do not install, correct, or replace door frames in a manner that results in any warranty or guarantee becoming void.

B. Special Techniques:

1. Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Install frames with removable glazing stops located on secure side of opening.
 - b. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - c. Install door silencers in frames before grouting.
 - d. Provide setting spreaders, supplied by the installer, and leave intact until frames are set square and plumb within specified tolerances, and all anchors are securely attached and grouted where required.
 - e. Remove frame spreader bars only after frames are properly set and secured. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
5. Ceiling Struts: Except where anchored to masonry or to other structural support at each jamb, extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame.
 - a. Bend top of struts to provide flush contact for securing to supporting construction.
 - b. Provide adjustable wedged or bolted anchorage to frame jamb members.
6. Glazing: Comply with installation requirements in Section 08 81 00 and with the manufacturer's instructions. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches O.C. and not more than 2 inches on center from each corner.

C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach door frames to supporting construction.

D. Installation Tolerances: Install frames within the following tolerance variations.

1. Maximum Out of Square: Not more than 1/16-inch, measured at rabbet on 90 degrees from jamb perpendicular to frame head.
2. Maximum Out of Alignment: Not more than 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Maximum Twist: Not more than 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Maximum Out of Plumb: Not more than 1/16-inch, measured on floor at jambs.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

3.4 CLEANING

- A. Cleaning Work: Clean all visible door frame surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed door frames in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed door frames unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed door frames as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 12 13

SECTION 08 13 13 – STANDARD HOLLOW METAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal doors.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 08 71 00 for door hardware.
 - 2. Section 08 81 00 for safety-rated glass.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. BMT: Base Metal Thickness.
 - 2. DHI: Door Hardware Institute.
 - 3. HM: Hollow Metal.
 - 4. MSG: Manufacturer's Standard Gage.
 - 5. DI: Steel Door Institute.
- B. Definitions:
 - 1. Manufacturer: Means the door frame manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate building opening tolerances with door frame manufacturing and erection tolerances.
 - 2. Coordinate hardware preparations, handing, and reinforcement requirements and locations with the Drawings, door schedule, and selected hardware sets.
 - 3. Coordinate door hardware finishes with other door hardware finishes.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.

2. Door Schedule: Submit schedule showing opening identification symbols and door and frame types and sizes, including thickness, swing, fire-resistance rating label requirements, undercuts, and finishes. Use the same reference numbers for openings and details as the Drawings.
 3. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to door schedule.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Doors must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
1. Fire-Protection Rating: Within fire-resistance rated assemblies, provide fire- protection-rated doors conforming to NFPA 80, "Standard for Fire Doors and Other Opening Protectives" and tested in conformance with NFPA 252, "Standard Methods of Fire Tests of Door Assemblies" and UL 10B, "Standard for Fire Tests of Door Assemblies"; or UL 10C, "Standard for Positive Pressure Fire Tests of Door Assemblies" for doors at atmospheric (neutral) pressure. A label or listing mark indicating the fire-protection rating must be permanently affixed at the factory in a location such that the label remains visible after the door is installed and must include UL "S" and "Positive Pressure Test" listings.
 2. Temperature Rise Rating: At vertical exit enclosures and exit passageways, provide doors with a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke-Control Door Assemblies: Provide doors conforming to the requirements of with NFPA 80, "Standard for Fire Doors and Other Opening Protectives" and tested in conformance with NFPA 105, "Standard for Smoke Door Assemblies and Other

Opening Protectives” or UL 1784, “Standard for Air Leakage Tests of Door Assemblies”.

- C. Quality Standard Requirements:
 - 1. Manufacturing Tolerances: Comply with the requirements of ANSI/SDI publication ANSI/SDI A250.8, “Recommended Specifications for Standard Steel Doors and Frames”.
 - 2. Hardware Preparations and Reinforcement: Comply with the requirements of ANSI/SDI A250.6, “Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames” with reinforcing plates fabricated from the same material as door face sheets.
 - 3. Door Hardware Installation Standards: Install door hardware in conformance with ANSI/DHI A115-IG, “Installation Guide for Doors and Hardware”.
- D. Qualifications:
 - 1. Manufacturer: Company or individuals must have at least 10 years’ experience manufacturing doors installed on at least 200 previous projects similar to this project in size, material, design, and complexity. Manufacturer must be a current member of SDI.
 - 2. Installer: Company or individuals must have at least 5 years’ experience installing doors for at least 30 previous projects similar to this project in size, material, design, and complexity. Installer must be a current member of SDI.
 - 3. Supervisors: Individuals must have at least 7 years’ experience installing doors for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years’ supervisory experience directing and leading door installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped, upright, and indoors within dry, well- ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
- C. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- D. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Allegion PLC.
 - 2. ASSA ABLOY.

3. Door Components, Inc.
4. MPI Custom Steel Doors and Frames.
5. Republic Doors and Frames.

2.2 STANDARD HOLLOW METAL FRAMES

- A. Description: Commercial full flush and seamless steel-stiffened doors.
- B. Products: “Steelcraft” frames manufactured by Allegion, or equal.
 1. Standard Duty Doors: “SL20” doors, or equal.
 2. Heavy Duty Doors: “BW18” doors, or equal.
 3. Extra Heavy Duty Doors: “BW16” doors, or equal.
 4. Maximum Duty Doors: “BW14” doors, or equal.
 5. Temperature Rise Rated Doors: “T-14” doors, or equal.
- C. Requisite Properties:
 1. Construction: Provide the following, conforming to SDI 108.
 - a. SDI Level 1 (standard-duty) and Physical Performance Level C, Model 1 (full flush) or Model 2 (seamless).
 - b. SDI Level 2 (heavy-duty) and Physical Performance Level B, Model 1 (full flush) or Model 2 (seamless).
 - c. SDI Level 3 (extra heavy-duty) and Physical Performance Level A, Model 1 (full flush), Model 2 (seamless), or Model 3 (stile and rail).
 - d. SDI Level 4 (heavy-duty) and Physical Performance Level A, Model 1 (full flush) or Model 2 (seamless).
 2. Construction: Provide the following, conforming to SDI 108.
 - a. Main Entrance and Exit Doors: Level 4 (maximum-duty), Model 2 (seamless with welded edge construction).
 - b. Stairwell Doors: Level 3 (extra heavy-duty), Model 2 (seamless with welded edge construction).
 - c. Toilet Room Doors: Level 3 (extra heavy-duty), Model 2 (seamless with welded edge construction).
 - d. Mechanical, Storage, and Utility Doors: Level 3 (extra heavy-duty), Model 2 (seamless with welded edge construction).
 - e. Gymnasium Doors: Level 3 (extra heavy-duty), Model 2 (seamless with welded edge construction).
 - f. Individual Office Doors: Level 1 (standard-duty), Model 1 (full flush).
 - g. Bathroom Doors: Level 1 (standard-duty), Model 1 (full flush).
 3. Types: SDI Indicated on the Drawings.
 4. Thickness: 1-3/4 inches.
 5. Face Sheets:
 - a. Exterior Doors: Fabricate from at least 0.0747-inch BMT (MSG 14) galvanized steel sheet. (maximum duty)
 - b. Interior Doors at Wet Locations, including Shower and Toilet Rooms: Fabricate from at least 0.0747-inch BMT (MSG 14) galvanized steel sheet. (maximum duty)
 - c. Interior Doors Located Elsewhere: Fabricate from at least 0.0598-inch BMT (MSG 16) CRS. (extra heavy duty)
 - d. Level 1 (standard duty): 0.0359-inch BMT (MSG 20)
 - e. Level 2 (heavy-duty): 0.0478-inch BMT (MSG 18)

- f. Level 3 (extra heavy-duty): 0.0598-inch BMT (MSG 16)
- g. Level 4 (maximum-duty): 0.0747-inch BMT (MSG 14)
- 6. Core Construction:
 - a. Exterior Insulated Doors: Maximum thermal transmittance (U-factor) value of not more than 0.50 BTU per hour per square foot per deg. F, when tested in conformance with ASTM C 1363.
 - b. Fire-Resistance Rated and Other Doors: Manufacturer's standard core necessary to meet indicated fire-resistance and temperature-rise ratings.
- 7. Vertical Edges: Manufacturer's standard edge with mechanical edge seam welded and finished before priming.
- 8. Top and Bottom Edges: Close edges with flush or inverted channels or end closures fabricated from same material as face sheets, but not less than at least 0.0747-inch BMT (MSG 14). Provide screw-on caps at exterior doors.
- 9. Minimum Hardware Reinforcement: Fabricate reinforcing from the same material as door in conformance with the following. Reinforcement must be offset to allow faces of mortised hardware devices to be installed flush with door surfaces.
 - a. Hinges: At least 0.1094-inch BMT (MSG 12) continuous stile extruded and tapped to at least 0.1875-inch BMT (MSG 07) reinforcement, unless another thickness and size are required by the by the hardware manufacturer based on actual in-service conditions applicable to the project.
 - b. Lock Front, Strike, and Flushbolt Reinforcement: At least 0.1094-inch BMT (MSG 12) by sizes required by the hardware manufacturer, unless another thickness is required by the by the hardware manufacturer based on actual in- service conditions applicable to the project.
 - c. Lock Reinforcement: At least 0.0625-inch BMT (MSG 16) by size as required by lock manufacturer, unless another thickness is required by the by the hardware manufacturer based on actual in-service conditions applicable to the project.
 - d. Closer Reinforcement: At least 0.0625-inch BMT (MSG 16) one-piece channel by size as required by the closer manufacturer, unless another thickness is required by the by the hardware manufacturer based on actual in-service conditions applicable to the project.
 - e. Exit Device Reinforcement: 0.0781-inch BMT (MSG 14) by 18 inches high by 3-3/16 inches wide, unless another thickness and size are required by the by the hardware manufacturer based on actual in-service conditions applicable to the project.
 - f. Other Hardware Reinforcement: Supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
 - g. Hardware manufacturers' recommended reinforcement units may be used in lieu of specified reinforcement.
- 10. Electrical Device Requirements: Make provisions for installation of electrified hardware and door electrical devices, and arrange so that wiring is readily installed, removed, and replaced.
 - a. Provide cutouts and reinforcement required for installation of devices.
 - b. Provide metal conduits or raceways to accommodate wiring between devices. (e.g., from electric hinge to other electric door hardware)

2.3 ACCESSORIES

- A. Filler: Material conforming to the requirements of SDI publication SDI 100, "Specifications for Standard Steel Doors and Frames". Use UL-listed materials in doors scheduled to have a fire-resistance rating.

- B. Vision Lights: “Vision Lite Kits” manufactured by TRUDOOR, LLC, or equal.
 - 1. Frames: At least at least 0.0359-inch BMT (MSG 20) uncoated steel sheet, with mitered and welded corners and countersunk mounting holes.
 - 2. Finish: Manufacturer’s standard powder coat finish.
 - 3. Frame Color: ProductOptions indicated on the Drawings or selected by the Architect.
 - 4. Safety-Rated Glass: Fully-tempered or laminated clear glass specified in Section 08 81 00.
- C. Door Louvers:
 - 1. Products: Provide the following manufactured by USA Fire Door LLC, or equal.
 - a. Standard Door Louvers: “800 Series”, or equal, 0.0478-inch BMT (MSG 18) uncoated steel louver door inserts.
 - b. Fire-Rated Door Louvers: “1900 Series”, or equal, 0.0478-inch BMT (MSG 18) uncoated steel louver door inserts.
 - 2. Requisite Properties:
 - a. Blades: Inverted Y or Z blades.
 - b. Minimum Free Area: Between 40 and 50 percent.
 - c. Finish: Manufacturer’s standard powder coat finish; custom colors selected by the Architect.
- D. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- E. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
 - 1. Provide cutouts and reinforcement required for installation of devices.
 - 2. Provide metal conduits or raceways to accommodate wiring between devices. (e.g., from electric hinge to other electric door hardware)

2.4 MATERIALS

- A. Uncoated Carbon Steel Sheet:
 - 1. Frame Material: Finished CRS coil, sheet, and strip conforming to ASTM A 1008, CS Type B (commercial steel), exposed, temper rolled, regular matte surface finish (40 to 59 AA), and oiled (sheet must be thoroughly cleaned to remove the oil prior to painting).
 - 2. Hardware Reinforcements: HRS coil, sheet, and strip conforming to ASTM A 1011, CS Type B (commercial steel), as-rolled surface finish, with cut edges.
- B. Zinc-Iron Alloy Coated (Galvannealed) Steel Sheet: ASTM A 653, CS Type B (commercial steel), with equal coating weight on each surface.
 - 1. Coating Weight (Mass) Designation: Provide at least a A60 (galvannealed) minimum coating weight (mass) designation.
 - 2. Surface Finish: Non-spangled matte finish.
 - 3. Surface Treatment: Provide mill phosphate surface treatment (paint-grip finish - provides enhanced lubricating characteristics).

2.5 FINISHES

- A. Uncoated Steel HM Frames: Provide shop-applied phosphate (paint-grip) pre-treatment and baked on rust inhibitive primer to all 6 door surfaces. Primer must be compatible with either field-applied paint or field-applied coating systems specified in Division 09, as applicable.
- B. Zinc Coated and Zinc-Iron Alloy Coated Steel and Stainless Steel HM Frames: Provide shop-applied bonderized pre-treatment. (not prime painted)

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install doors in conformance with the quality standards publications using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Perform drilling and fitting as required or necessary for an accurate fit and complete installation.
 - 4. Installed doors must be warrantable. Do not install, correct, or replace doors in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach doors to supporting construction.
- C. Installation Tolerances:
 - 1. Fire-Rated Doors: Install doors with clearances in conforming to NFPA 80.
 - 2. Smoke- Control Doors: Install doors with clearances in conforming to NFPA 105.

3. Other Doors: Install doors within the following clearance variations.
 - a. Jambs and Head: 1/8-inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8-inch plus or minus 1/16-inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 1/4-inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 1/4-inch.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

3.4 ADJUSTING

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible door frame surfaces in a manner that does not result in any warranty or guarantee becoming void.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.

2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed doors in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed doors unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed doors as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 13 13

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood veneer-faced flush wood doors.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 08 71 00 for door hardware.
 - 2. Section 08 81 00 for safety-rated glass.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. DHI: Door Hardware Institute.
 - 2. WDMA: Wood Door Manufacturers Association.
- B. Definitions:
 - 1. Manufacturer: Means the door manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate building opening tolerances with door frame manufacturing and erection tolerances.
 - 2. Coordinate hardware preparations, handing, and reinforcement requirements and locations with the Drawings, door schedule, and selected hardware sets.
 - 3. Coordinate door hardware finishes with other door hardware finishes.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)

2. Door Schedule: Submit schedule showing opening identification symbols and door and frame types and sizes, including thickness, swing, fire-resistance rating label requirements, undercuts, and finishes. Use the same reference numbers for openings and details as the Drawings.
 3. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to door schedule.
 4. Samples: Submit at least 8-inch square representative samples of each door color, finish, and variety.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished flashings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals:
1. Maintenance Data: Submit copies of manufacturer's instructions and other requirements and recommendations for door maintenance, cleaning, and repair to the Architect as a condition of project closeout.
 2. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Doors must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
1. Fire-Protection Rating: Within fire-resistance rated assemblies, provide fire- protection-rated doors conforming to NFPA 80, "Standard for Fire Doors and Other Opening Protectives" and tested in conformance with NFPA 252, "Standard Methods of Fire Tests of Door Assemblies" and UL 10B, "Standard for Fire Tests of Door Assemblies";

- or UL 10C, “Standard for Positive Pressure Fire Tests of Door Assemblies” for doors at atmospheric (neutral) pressure. A label or listing mark indicating the fire-protection rating must be permanently affixed at the factory in a location such that the label remains visible after the door is installed and must include UL “S” and “Positive Pressure Test” listings.
2. Smoke-Control Door Assemblies: Provide doors conforming to the requirements of with NFPA 80, “Standard for Fire Doors and Other Opening Protectives” and tested in conformance with NFPA 105, “Standard for Smoke Door Assemblies and Other Opening Protectives” or UL 1784, “Standard for Air Leakage Tests of Door Assemblies”.
- C. Quality Standard Requirements:
1. Product Standard: Comply with the requirements Window & Door Manufacturers Association publication ANSI/WDMA I.S.1-A, “Industry Standard for Interior Architectural Wood Flush Doors”.
 2. Door Hardware Installation Standards: Install door hardware in conformance with ANSI/DHI A115-IG, “Installation Guide for Doors and Hardware”.
- D. Qualifications:
1. Manufacturer: Company or individuals must have at least 10 years’ experience manufacturing doors installed on at least 200 previous projects similar to this project in size, material, design, and complexity. Manufacturer must be a current member of SDI.
 2. Installer: Company or individuals must have at least 5 years’ experience installing doors for at least 30 previous projects similar to this project in size, material, design, and complexity. Installer must be a current member of SDI.
 3. Supervisors: Individuals must have at least 7 years’ experience installing doors for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years’ supervisory experience directing and leading door installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped, upright, and indoors within dry, well- ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.
 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer’s instructions and other requirements and recommendations, and in a manner that that prevents damage. Avoid damage to packaging and containers.

- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Algoma Hardwoods, Inc.
 - 2. Eggers Industries.
 - 3. Marshfield DoorSystems, Inc.
 - 4. Oshkosh Architectural Door Co.

2.2 WOOD VENEER-FACED DOORS

- A. Description: Flush wood doors conforming to WDMA I.S.1-A Performance Grade Heavy Duty.
- B. Application: Transparent finish wood doors.
- C. Restrictions: Doors manufactured with adhesives and composite wood products containing urea formaldehyde are prohibited.
- D. Product: “Signature Series” doors manufactured by Marshfield DoorSystems, Inc., or equal.
- E. Requisite Properties:
 - 1. Type: Solid Core.
 - 2. Grade: Premium.
 - 3. Thickness: 1-3/4 inches.
 - 4. Construction: 5-ply.
 - 5. Core: Manufacturer’s standard wood-based particleboard, structural composite lumber, or fire-resistant composite or mineral core, or specialty core.
 - 6. Edge Construction: Structural composite lumber or hardwood lumber stiles and rails securely bonded to core components and machine calibrated before veneering, with edge banding veneer matching face veneer species and grade.
 - 7. Meeting Edge: Beveled at lock stile, square edged at strike stiles.

8. Hardware Blocking: As required by hardware manufacturer to eliminate through- bolting hardware.
 - a. 5-by-18-inch lock blocks at both stiles.
 - b. 5-inch top rail blocking for closers and 5-inch bottom rail blocking where automatic door bottoms are indicated.
 - c. 2-1/2-inch mid-rail blocking.
9. Exposed Vertical Surfaces: Wood veneer.
 - a. Veneer Grade:
 - b. Face Cut and Veneer Species:
 - c. Grain Direction:
 - d. Veneer Match:
10. Transparent Finish: Design Selections indicated on the Drawings or selected by the Architect, or equal.
 - a. Grade: Premium.
 - b. Surface Finish: Clear conversion varnish.
 - c. Stain:
 - d. Sheen:
11. Horizontal Surfaces: Structural composite lumber.
12. Openings: Cut and trim openings through doors in factory.
 - a. Light Openings: Trim openings with materials and profiles indicated.
 - b. Glazing: Field install glazing.
 - c. Louvers: Factory install louvers in prepared openings.

2.3 ACCESSORIES

- A. Vision Lights: “Vision Lite Kits” manufactured by TRUDOOR, LLC, or equal.
 1. Frames: At least at least 0.0359-inch BMT (MSG 20) uncoated steel sheet, with mitered and welded corners and countersunk mounting holes.
 2. Finish: Manufacturer’s standard powder coat finish.
 3. Frame Color: Product Options indicated on the Drawings or selected by the Architect.
 4. Safety-Rated Glass: Fully-tempered or laminated clear glass specified in Section 08 81 00.
- B. Door Louvers:
 1. Products: Provide the following manufactured by USA Fire Door LLC, or equal.
 - a. Standard Door Louvers: “800 Series”, or equal, 0.0478-inch BMT (MSG 18) uncoated steel louver door inserts.
 - b. Fire-Rated Door Louvers: “1900 Series”, or equal, 0.0478-inch BMT (MSG 18) uncoated steel louver door inserts.
 2. Requisite Properties:
 - a. Blades: Inverted Y or Z blades.
 - b. Minimum Free Area: Between 40 and 50 percent.
 - c. Finish: Manufacturer’s standard powder coat finish; custom colors selected by the Architect.
- C. Electrical Device Requirements: Make provisions for installation of electrified hardware and door electrical devices, and arrange so that wiring is readily installed, removed, and replaced.
 1. Provide cutouts and reinforcement required for installation of devices.
 2. Provide metal conduits or raceways to accommodate wiring between devices. (e.g., from electric hinge to other electric door hardware)

- D. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- E. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install doors in conformance with the quality standards publications using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Perform drilling and fitting as required or necessary for an accurate fit and complete installation.
 - 4. Installed doors must be warrantable. Do not install, correct, or replace doors in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Factory-Fitted Doors: Align in frames for uniform clearance at each edge. Hang doors to operate freely for their entire travel, but not loosely, without sticking or hinge binding, with hardware adjusted and functioning properly.
 - 2. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach doors to supporting construction.
- D. Installation Tolerances:
 - 1. Fire-Rated Doors: Install doors with clearances in conforming to NFPA 80.
 - 2. Smoke- Control Doors: Install doors with clearances in conforming to NFPA 105.
 - 3. Other Doors: Install doors within the following clearance variations.
 - a. Jambs and Head: 1/8-inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8-inch plus or minus 1/16-inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 1/4-inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 1/4-inch.

3.3 ADJUSTING

- A. Verify smooth and quiet door and hardware operation.
- B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- C. Rehang or replace doors that do not operate freely in a safe and reliable manner.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible door frame surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.

2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed doors in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed doors unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed doors as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 14 16

SECTION 08 31 16 – ACCESS PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal access panel assemblies.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. BMT: Base Metal Thickness.
- B. Definitions:
 - 1. Manufacturer: Means the access panel manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate locations of items and equipment being accessed with access panel sizes and locations indicated on the Drawings.
 - 2. Coordinate hardware preparations, handing, reinforcement requirements, and locations with the Drawings, access panel manufacturer, and selected hardware sets.
- B. Acoustical Requirements:
 - 1. Provide fire-rated access doors with continuous piano-style hinges at sound-rated construction.
 - 2. Seal door flange perimeter with “S88” adhesive-backed fire and smoke gasketing manufactured by Pemko Manufacturing Co., Inc., or equal.
 - 3. Seal entire assembly to gypsum board with acoustical sealant.
 - 4. Include 1-1/2-inch-thick minimum insulation laminated with at least 2 pound per square foot density material such as gypsum board.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings:

- a. Submit dimensioned plans and elevations drawn to scale and showing access panel locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans and elevations.
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished access panels.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project- specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Access panels must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Doors must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 3. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped, upright, and indoors within dry, well- ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.

- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage. Avoid damage to packaging and containers.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 METAL ACCESS PANEL AND FRAMES

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Activar Construction Products Group, Inc.
 - 2. Acudor Products, Inc.
 - 3. Karp Associates, Inc.
 - 4. Nystrom Building Products.
- B. Non-Rated Access Panels at Ceramic Tile Wall Finishes:
 - 1. Description: Flush stainless steel access panels and frames.
 - 2. Product: "JL Industries Model TMS" manufactured by Activar Construction Products Group, Inc., or equal.
 - 3. Material: Type 304, 0.0625-inch BMT (USSG 16) stainless steel frame with at least 0.0625-inch BMT (USSG 16) stainless steel door.
 - 4. Trim: At least 0.0312-inch BMT (USSG 22) stainless steel flange.
 - 5. Hinge: Concealed continuous piano hinge.
- C. Non-Rated Access Panels Elsewhere:
 - 1. Description: Flush concealed frame access panels with wallboard bead.
 - 2. Product: "JL Industries Model TMW" manufactured by Activar Construction Products Group, Inc., or equal.
 - 3. Material: At least 0.0598-inch BMT (MSG 16) cold-rolled uncoated steel sheet frame and 0.0598-inch BMT (MSG 16) cold-rolled uncoated steel sheet door.
 - 4. Trim: At least 0.0299-inch BMT (MSG 22) HDG steel sheet gypsum board tape-in bead flange.
 - 5. Hinge: Concealed continuous piano hinge.
 - 6. Finish: Manufacturer's standard shop-applied phosphate pre-treatment and baked on rust inhibitive primer for field-applied finish.
- D. Fire-Resistance Rated Access Panels:
 - 1. Description: Fire-rated and insulated concealed frame access panel with wallboard bead.
 - 2. Product: "JL Industries Model FDW" manufactured by Activar Construction Products Group, Inc., or equal.
 - 3. Material: At least 0.0598-inch BMT (MSG 16) cold-rolled uncoated steel sheet frame with At least 0.0359-inch BMT (MSG 20) cold-rolled uncoated steel sheet door.

4. Trim: At least 0.0299-inch BMT (MSG 22) HDG steel sheet gypsum board tape-in bead flange.
 5. Insulation: At least 2-inch thick fire-resistive mineral wool insulation sandwiched between access panel faces.
 6. Hinge: Concealed continuous piano hinge.
 7. Finish: Manufacturer's standard shop-applied phosphate pre-treatment and baked on rust inhibitive primer for field-applied finish.
- E. Requisite Properties:
1. Provide at least 24-inch square or larger panel assemblies where servicemen must access spaces through panels.
 2. Elsewhere, provide at least 12-inch square panel assemblies.
- F. Accessories:
1. Locking Devices:
 - a. Public Areas: Provide one mortise cylinder lock per access door. Key all locks alike, unless otherwise noted.
 - b. Other Areas: Provide flush, key-operated cam lock. Key all locks alike, unless otherwise noted.
 - c. Panels 24 inches or More in Any Dimension: Provide interior latch to permit access panel opening from inside without a key.
 2. Gaskets: Apply manufacturer's optional gasketing to frames of units that do not come standard with gaskets.
 3. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
 4. Other Accessories: Provide other accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install access panels using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed access panels must be warrantable. Do not install, correct, or replace access panels in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach access panels to supporting construction.
- C. Installation Tolerances: Install access panels to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 ADJUSTING

- A. Verify smooth and quiet door and hardware operation.
- B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- C. Rehang or replace doors that do not operate freely in a safe and reliable manner.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible access panel surfaces in a manner that does not result in any warranty or guarantee becoming void.

1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed access panels in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on or adjacent to or against installed access panels unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed access panels as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 31 16

SECTION 08 36 13 – OVERHEAD SECTIONAL DOORS

1.1 SUMMARY

- A. Section Includes:
 - 1. Overhead sectional doors.
 - 2. Operators and controls.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the sectional door manufacturer, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
 - 2. Door Schedule: Submit schedule showing opening identification symbols and overhead door and frame types and sizes, including mounting, operation, and fire- resistance rating requirements. Use the same reference numbers for openings and details as the Drawings.
 - 3. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
 - 4. Wiring Diagrams: Submit wiring diagrams for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring; and between components furnished by the manufacturer and those indicated in other specification sections.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished sectional doors.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.

- b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals:
 - 1. Maintenance Data: Submit copies of manufacturer's instructions and other requirements and recommendations for integrated door maintenance, cleaning, and repair to the Architect as a condition of project closeout.
 - 2. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.
- D. Maintenance Material Submittals:
 - 1. Deliver to the Owner tools and other implements to safely service and reset each sectional door.
 - 2. Furnish at least one set of tools and other implements for each sectional door.

1.4 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Sectional doors must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Qualifications:
 - 1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing counter doors installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
 - 2. Installer: Company or individuals must have at least 5 years' experience installing counter doors for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - 3. Supervisors: Individuals must have at least 7 years' experience installing counter doors for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading counter door installers.

1.5 HANDLING

- A. Receiving and Inspection: Inspect all deliveries for deteriorated, damaged, and defective items. Reject items that are not packaged in a manner that prevents damage; or that exhibit

deterioration or damage or have damaged or open packaging or containers. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.

- B. Unloading: With minimum handling, unload and store only inspected and accepted items.
- C. Storage: Store unloaded items as shipped, upright in their original packaging or containers, indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.6 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 10 years; and for finishes against color fading, chalking, cracking, checking, peeling, and adhesive failure for 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Provide products manufactured by one of the following, or equal.
 - 1. CornellCookson, Inc.
 - 2. McKeon Door Co.
 - 3. Overhead Door Corp.

2.2 GLAZED OVERHEAD SECTIONAL DOORS

- A. Description: Glazed aluminum, manual and motorized sectional doors.
- B. Products: "Model No. 521" manufactured by Overhead Door Corp., or equal.
- C. Requisite Properties:
 - 1. Model: Manual and electric-operated aluminum and glass doors with insulated stiles and rails.
 - 2. Sizes: Indicated on the Drawings.
 - 3. Panel Thickness: 1-3/4 inches.
 - 4. Glazing: Manufacturer's 1/2-inch insulated glass.
 - 5. Top Rail Width: 2-3/8 inches.
 - 6. Bottom Rail Width: 3-3/4 inches.
 - 7. Track: 3 inches.

8. Bottom Sensing Edge: Manufacturer's standard.
9. Glazing Thickness: One-inch.
10. Glazing Stops: Square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.
11. Exposed Finishes: Match storefront framing.

2.3 INSULATED OVERHEAD SECTIONAL DOORS

- A. Description: Insulated sectional steel-back door.
- B. Products: "Model No. 470" manufactured by Overhead Door Corp., or equal.
- C. Requisite Properties:
 1. Sizes: Indicated on the Drawings.
 2. Panel Thickness: 2 inches.
 3. Minimum Exterior Steel Thickness: At least 0.0179-inch BMT (MSG 26).
 4. Exterior Surface: Ribbed, woodgrain embossed
 5. Insulation: Bonded polystyrene.
 6. Minimum Interior Steel Thickness: At least 0.0135-inch BMT (MSG 29).
 7. Track: 3 inches.
 8. Bottom Sensing Edge: Manufacturer's standard.
 9. Exposed Finishes: ProductOptions indicated on the Drawings or selected by the Architect.

2.4 OPERATIONS AND CONTROLS

- A. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second, and meeting UL 325/2010 requirements for continuous monitoring of safety devices.
- B. Entrapment Protection: Required for momentary contact, includes radio control operation.
- C. Operator Controls:
 1. Model: "RSX", or equal, 3/4-horsepower electric operator.
 2. Push-button operated control stations with open, close, and stop buttons.
 3. Mounting: Center mount.

2.5 ACCESSORIES

- A. Weatherseals: Provide manufacturer's standard weather stripping gaskets fitted to the entire door perimeter to provide a weathertight installation.
- B. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- C. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install sectional doors using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed sectional doors must be warrantable. Do not install, correct, or replace sectional doors in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Provide necessary hardware, anchors, inserts, hangers, equipment supports and other accessories required for a complete installation.
 - a. Use concealed fasteners and anchorages where practicable.
 - b. Attach guide assemblies to walls with galvanized bolts for a rigid installation of the door and operating equipment.
 - 2. Form closely-fitted joints with exposed connections accurately located and secured.
 - 3. Provide uniform-width perimeter reveals and openings sealants and joint fillers as indicated.
 - 4. Lubricate, test and adjust overhead door and door, including controls and safeties, to operate easily, free from warp, twist or distortion, and fitting weather tight for the entire perimeter of the overhead door.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach counter doors to supporting construction and to safely connect facility services.
- D. Installation Tolerances: Install counter doors to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 ADJUSTING

- A. Verify smooth and quiet counter door operation.
- B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- C. Replace items that do not operate freely in a safe and reliable manner.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed access panels in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed counter doors unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed counter doors as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

3.7 CLOSEOUT ACTIVITIES

- A. Demonstration:
 - 1. Engage a factory-authorized service representative to perform startup services and train maintenance personnel.

2. Demonstrate the successful operation of each counter door for 3 consecutive complete opening and closing cycles.

END OF SECTION 08 36 13

SECTION 08 53 13 – VINYL WINDOWS

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl windows.
 - 2. Site tests and inspections.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. AAMA: American Architectural Manufacturers Association.
 - 2. WDMA: Window & Door Manufacturers Association.
 - 3. CSA: Canadian Standards Association.
- B. Definitions:
 - 1. Manufacturer: Means the window manufacturer, unless otherwise indicated.
 - 2. Failure: Includes noise or vibration caused by movement, material deterioration beyond normal weathering, water leakage through fixed glazing and framing areas, and failure of operating components.
 - 3. Water Leakage: Means no uncontrolled water penetrating assemblies or water appearing on assemblies' normally-exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to the exterior.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate building opening tolerances with window manufacturing and erection tolerances.
 - 2. Coordinate window hardware finishes with door hardware finishes.
- B. Performance Requirements:
 - 1. General: Windows must establish and maintain a continuous watertight seal without failure.
 - 2. Thermal Transmittance (U-Factor): Maximum assembly thermal transmittance value may not exceed the following.
 - a. Maximum Winter Nighttime Transmittance (U-value): Not more than 0.36 for fixed assemblies; and 0.46 BTU per hour per square foot per deg. F. for operable assemblies.
 - b. Maximum Summer Daytime Transmittance (U-value): Not more than 0.42 BTU per hour per square foot per deg. F.
 - 3. Condensation Resistance Factor (CRF): Minimum CRF value of at least the following, when tested in conformance with NFRC 500.

- a. Maximum Winter Nighttime Transmittance (U-value): Not more than 0.36 for fixed assemblies; and 0.46 BTU per hour per square foot per deg. F. for operable assemblies.
 - b. Maximum Summer Daytime Transmittance (U-value): Not more than 0.42 BTU per hour per square foot per deg. F.
 4. Sound Transmission Class (STC): Provide complete assemblies (both frame and glazing) having a minimum laboratory-tested STC value of at least that indicated on the Drawings for glass and frame together, as determined in conformance with ASTM E 413, based on testing in conformance with ASTM E 90.
 5. Outdoor-Indoor Transmission Class (OITC): Provide complete assemblies (both frame and glazing) having a minimum laboratory-tested OITC value of at least that indicated on the Drawings for glass and frame together, as determined in conformance with ASTM E 413, based on testing in conformance with ASTM E 90.
 6. Operating Force for Sliding Window Assemblies: Not more than 30 pounds-force required to open the window, nor more than 20 pounds-force to keep the window in motion, when tested in conformance with ASTM E 2068.
 7. Operable Window De-Glazing Test: Operable sash or panel member must not move from the original position, relative to glazing, by more than the glass bite depth, when tested in conformance with ASTM E 987 at a 70 pounds-force concentrated load on vertical rails and a 50 pounds-force concentrated load on other rails.
 8. Forced-Entry Resistance: Operable window assemblies within 15 feet of grade or accessible platform must be rated at least Performance Grade 30, when tested in conformance with ASTM F 588 according to window assembly type classification.
 9. Thermal Expansion and Contraction: Accommodate movement resulting from at least 120 deg. F ambient and 180 deg. F material surface temperature differentials (changes).
 10. Dissimilar Metal Corrosion Protection: Permanently isolate metal surfaces from direct contact with incompatible materials and other potentially corrosive substrates as specified in Section 05 50 00.
- C. Preinstallation Meeting:
1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation
 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed windows. Resolve each condition.
 4. Finalize construction schedule.
 5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Sectional doors must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.

- b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing window layout, materials, construction, and finishes. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans and elevations.
 - 3. Samples:
 - a. Submit at least 6-inch square representative samples of each window frame and sash color and finish.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished windows.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
 - 1. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Windows must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
 - 1. Windows must conform to the requirements of International Building Code. Where glazed openings are provided in accessible rooms or spaces for operation by occupants, at least one must conform to the requirements of International Building Code.
- C. Quality Standard Requirements:

1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing windows installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
 2. Installer: Company or individuals must have at least 5 years' experience installing windows for at least 30 previous projects similar to this project in size, material, design, and complexity.
 3. Supervisors: Individuals must have at least 7 years' experience installing windows for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading window installers.
- D. Mockups: If an ex-situ exterior wall integrated mockup is required for this project, then integrate windows into the mockup as part of the work of this specification section.

1.6 HANDLING

- A. Receiving and Inspection: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
1. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage.
 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 4. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to other sources of deterioration and damage.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective windows with undamaged new windows that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 10 years.

- B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Provide products manufactured by one of the following, or equal.
 - 1. Milgard Manufacturing, Inc.
 - 2. JELD-WEN, Inc.

2.2 VINYL WINDOWS

- A. Description: Vinyl plastic-framed window units with integral one-inch nail fin and mitered and fusion-welded corners; and tested and labeled for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 requirements for Class F-HC40 (fixed windows) and Class C-C55. (operable casement windows)
- B. Product: “Tuscany Series” manufactured by Milgard Manufacturing, Inc., or equal., or equal.
- C. Requisite Properties:
 - 1. Style: Indicated on the Drawings.
 - 2. Sizes: Indicated on the Drawings.
 - 3. Exposed Finishes: Solid vinyl with smooth gloss finish and uniform consistent color.
 - 4. Color: ProductOptions indicated on the Drawings or selected by the Architect.
- D. Components:
 - 1. Glazing Gaskets: Manufacturer's standard black gaskets.
 - 2. Glazing Stop: Snap-on PVC matching panel frame finish.
 - 3. Sash and Frame: Impact resistant, exterior grade PVC profiles conforming to AAMA 303.
 - 4. Glazing: Nominal one-inch thick fully tempered dual-glazed IGU conforming to ASTM E 2190 requirements, with a U-Factor of at least 0.25 and a SHGC of at least 0.22. Provide “SunCoatMAX Low-E/Clear”, or equal.
 - a. Glass Panes: ASTM C 1036, Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
 - b. Interspace: Hermetically sealed air-filled interspace.
 - c. Seals: Black polyisobutylene primary sealant; black silicone secondary sealant.

2.3 ACCESSORIES

- A. Window Sills and Stools: DesignSelections indicated on the Drawings or selected by the Architect, or equal.
- B. Fiberglass Insect Screens:
 - 1. Description: Vinyl-coated fiberglass mesh insect screening fabric.

2. Product: "Phiferglass" manufactured by Phifer Wire Products, Inc., or equal.
3. Requisite Properties:
 - a. Window and Door Screens: 18x16 nominal mesh count, woven from 0.010-inch diameter permanent glass yarn; 59 percent minimum free area (openness).
 - b. Pool, Patio and Porch Screen: 18x14 nominal mesh count, woven from 0.013-inch diameter permanent glass yarn; 58 percent minimum free area (openness).
 - c. No-See-Um Mesh Screen: 20x20 nominal mesh count, woven from 0.013-inch diameter permanent glass yarn; 45 percent minimum free area (openness).
 - d. Color: Match Phifer color "Black".
 - e. Frame: Rolled aluminum frame; match window finish.
- C. Hardware: Manufacturer's standard factory-installed operating hardware; finish must match adjacent door hardware.
- D. Glazing Gaskets: Manufacturer's standard ethylene propylene diene monomer (EPDM) conforming to ASTM C 864 and having a Shore A hardness value of at least 70, unless another type of gasket is supplied, required, recommended, or accepted by the manufacturer.
- E. Brackets: Provide high-strength aluminum or non-magnetic austenitic stainless steel brackets and reinforcements.
- F. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
 1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 2. Reinforce framing members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- G. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 1. Identify project conditions that do not conform to the manufacturer's instructions

- and other requirements and recommendations.
- 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install windows using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed windows must be warrantable. Do not install, correct, or replace windows in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Use concealed fasteners and anchorages. Provide washer head fasteners with bonded sealing washers where required to protect metal surfaces and to make weathertight connections.
 - 2. Form closely-fitted joints with exposed connections accurately located and secured.
 - 3. Provide uniform-width perimeter reveals and opening sealants and joint fillers as indicated.
 - 4. Install concealed gaskets, flashings, and joint fillers as the window installation
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach windows to supporting construction.
- D. Installation Tolerances: Install windows to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 ADJUSTING

- A. Verify smooth and quiet window and hardware operation.
- B. Verify smooth and quiet counter door operation.
- C. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- D. Replace items that do not operate freely in a safe and reliable manner.

3.4 FIELD QUALITY CONTROL

- A. Site Tests and Inspections:
 - 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - a. Schedule and arrange all tests and inspections.

- b. Coordinate all work and the final construction schedule with all tests and inspections.
 - c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.
 - d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site tests and inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
2. Required Tests:
- a. Water Leakage Hose Tests: Perform water leakage hose tests in conformance with ASTM AAMA 501.2 (fixed glazing assemblies) and AAMA 502 (operable window units)

3.5 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.6 CLEANING

- A. Cleaning Work: Clean all visible window surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.

3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.7 PROTECTION

- A. Protect installed access panels in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed counter doors unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed counter doors as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 53 13

SECTION 08 81 00 – GLASS GLAZING

1.1 SUMMARY

- A. Section Includes:
 - 1. Annealed glass.
 - 2. Strengthened glass.
 - 3. Coated glass.
 - 4. Laminated glass.
 - 5. Insulating glass units.
 - 6. Delegated design of glazing.
 - 7. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. GANA: Glazing Association of North America.
 - 2. IGCC: Insulating Glass Certification Council.
 - 3. IGMA: Insulating Glass Manufacturers Alliance.
 - 4. IGU: Insulating Glass Unit.
 - 5. NGA: National Glass Association.
 - 6. PVB: Polyvinyl Butyral.
 - 7. SGCC: Safety Glazing Certification Council
 - 8. SIGMA: Sealed Insulating Glass Manufacturers Association.
- B. Definitions:
 - 1. Manufacturer: Means the glass manufacturer, unless otherwise indicated.
 - 2. Fabricator: Means the glass fabricator, unless otherwise indicated.
 - 3. Failure: Includes material deterioration beyond normal weathering, coating degeneration, the development of defects not attributed to glass breakage or to maintaining and cleaning coated glass contrary to the manufacturer or fabricator instructions, failure of a IGU hermetic seals, and failure of glazing sealants or gaskets to remain watertight and airtight.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate IGU spacer finish with all finishes of framing into which IGUs are installed.
- B. Delegated Design Requirements:
 - 1. Engineer, fabricate, assemble, and install glazing that conforms to the sizes and thicknesses indicated and other Contract Document requirements; meets specified performance requirements; and results in structurally sound and weathertight assemblies that accommodate, resist, distribute, or transfer in-service loads without incipient or catastrophic failure.

2. Maintain visual design concept indicated, including sizes and alignments. Deviation from visual design concept is non-conforming work and prohibited without prior written acceptance by the Architect.
- C. Performance Requirements:
1. General: Installed glass glazing must establish and maintain a continuous watertight seal without failure.
 2. Design Pressure: Calculate in conformance with American Society of Civil Engineers/ Structural Engineering Institute publication ASCE/SEI 7, “Minimum Design Loads and Associated Criteria for Buildings and other Structures”.
 3. Load Resistance: Provide glazing materials conforming to ASTM E 1300.
 4. Differential Shading: Accommodate, resist, distribute, or transfer thermal stresses induced by differential shading within individual glass lites.
 5. Glass Thickness: Thicknesses indicated are estimates; determine actual required thicknesses. Overall thickness of each glass type and composite thickness of multiple-layer glass types must be consistent throughout the project.
 - a. Minimum thicknesses must be such that the probability of breakage at design pressure does not exceed 8 lights per 1,000 lights (SF 2.5), based on a 3-second gust wind load duration and the reflectance and shading indicated.
 - b. Exterior glass thickness must be at least 6.0mm (nominal 1/4-inch).
 6. Minimum Glass Bite Depth: At least 3/8-inch glass bite depth for 6mm (nominal 1/4-inch) monolithic lites, and 1/2-inch for 12mm (nominal 1/2-inch) laminated glass and 25mm (nominal one-inch) IGUs, unless otherwise indicated.
 7. Minimum Edge Clearance: At least 1/4-inch for 6mm (nominal 1/4-inch) monolithic lites, 12mm (nominal 1/2-inch) laminated glass, and 25mm (nominal one-inch) IGUs, unless otherwise indicated.
 8. Minimum Face Clearance: At least 1/8-inch for 6mm (nominal 1/4-inch) monolithic lites and 12mm (nominal 1/2-inch) laminated glass, and 3/16-inch for 25mm (nominal one-inch) IGUs, unless otherwise indicated.
 9. Safety Glazing Requirements: Provide either laminated glass or fully tempered glass conforming to ANSI Z97.1 requirements for Drop Height Class A wherever safety glazing is indicated or required. Wire glass is prohibited.
 10. Other Requirements: Installed glass must be free from rattle.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Product Data:
 - a. Submit manufacturer’s product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
 2. Glazing Schedule: Submit glazing schedule indicating glazing types, locations, sizes, thicknesses, and extents.
 3. Samples: Submit at least 8-inch square representative samples of each glass and fabricated glass assembly type, color, finish, and variety.

- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Delegated Design Submittals: Together with shop drawings, submit engineering calculations demonstrating conformance to the Contract Documents and all impacts of delegated design scope of work on other work.
 - a. Calculations must be explicit and legible and must incorporate distinct cross-references to submitted shop drawings in sufficient quantity to render the calculations readily intelligible and reviewable.
 - b. At a minimum, calculations must include design loads; analysis of supporting construction, including section-property computations; analysis of fasteners, anchors, attachments, and connectors; and signature and seal of the licensed professional engineer responsible for preparing them.
 - c. Test reports are not an acceptable substitute for calculations and are returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
1. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Glazing must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
- B. Safety Glazing Certification:
1. Each pane of safety glass delivered to the project site must be furnished with a permanent identification label or mark that identifies the labeler and indicates that safety glazing material is utilized for the installation. Each label must be permanently affixed in a location such that the label remains visible after the pane of glass is installed.
 2. Each pane of tempered glass delivered to the project site must be furnished with a permanent identification label or mark etched or ceramic-fired onto the glass surface that identifies the manufacturer or fabricator and indicates that tempered glass is utilized for the installation. Each label or mark must be permanently affixed in a location such that the label or mark remains visible after the pane of glass is installed
- C. Insulating Glass Certification:
1. Each insulating glass unit delivered to the project site must be furnished with a permanent certification label issued by the Insulating Glass Certification Council (IGCC) (which assures quality and performance of sealed insulating glass products) or the National Accreditation and Management Institute (NAMI) (which assures the buyer that the purchase product is the same product that was tested by an independent laboratory,

and performs to the level that the test report reflects) that identifies the labeler and indicates the performance of sealed insulating glass units utilized for the installation; each label must be permanently affixed in a location such that the label remains visible after the glass unit is installed.

D. Qualifications:

1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing glazing installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
2. Fabricator: Company or individuals must have at least 10 years' experience fabricating glazing installed on at least 100 previous projects similar to this project in size, material, design, and complexity.
3. Installer: Company or individuals must have at least 5 years' experience installing glazing for at least 30 previous projects similar to this project in size, material, design, and complexity.
4. Supervisors: Individuals must have at least 7 years' experience installing glazing for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading glazing installers.
5. Engineer: Must be a licensed professional structural engineer registered to practice in Massachusetts having at least 10 years' experience performing the kind of engineering services indicated for at least 20 previous projects similar to this project in size, material, design, and complexity.

1.6 HANDLING

- A. Receiving and Inspection:** Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- B. Storage:** Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
1. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage.
 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 4. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to other sources of deterioration and damage.
- C. Handling:** Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement:** Promptly remove and replace deteriorated, damaged, or defective windows with undamaged new windows that do not exhibit deterioration, damage, or defects.

- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 10 years.
- B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Provide products manufactured by one of the following, or equal.
 - 1. Guardian Industries Corp.
 - 2. Pilkington North America, Inc.
 - 3. PPG Industries.
 - 4. Saint-Gobain Corp.

2.2 MANUFACTURED GLASS

- A. Clear Annealed Vision Glass:
 - 1. Description: ASTM C 1036, Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
- B. Ultra-Clear (Low Iron) Annealed Vision Glass:
 - 1. Description: ASTM C 1036, Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
 - 2. Products: Provide one of the following, or equal.
 - a. "UltraWhite" manufactured by Guardian Industries Corp.
 - b. "OptiWhite" manufactured by Pilkington North America, Inc.
 - c. "Starphire" manufactured by PPG Industries.
 - d. "DIAMANT" manufactured by Saint-Gobain Glass.
 - 3. Performance Requirements:
 - a. Visible Light Transmittance (VLT): At least 90 percent at 6mm thickness.

2.3 SECONDARY GLASS FABRICATORS

- A. Fabricators: Provide products fabricated by one of the following, or equal.
 - 1. Oldcastle BuildingEnvelope Corp.
 - 2. PPG Industries.

3. Viracon, Inc.

2.4 ACCESSORIES

A. Heat-Strengthened Glass:

1. Description: ASTM C 1048, Kind HS (heat strengthened), Condition A (uncoated surfaces), Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
2. Minimum Surface Compression Strength (up to 1/4-inch thick): 4,000 to 7,000 pounds per square inch.
3. Minimum Surface Compression Strength (5/16 to 3/8-inch thick): 5,000 to 8,000 pounds per square inch.
4. Fabrication:
 - a. Except where not practicable due to glass size, fabricate tempered glass by the horizontal (roller hearth) process with roll wave distortion parallel to the bottom glass edge when installed, unless otherwise indicated.
 - b. Do not exceed 1/32-inch bow and warp tolerances.

B. Fully-Tempered (Toughened) Glass:

1. Description: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
2. Minimum Surface Compression Strength: At least 10,000 pounds per square inch.
3. Fabrication:
 - a. Fabricate tempered glass by the horizontal (roller hearth) process with roll wave distortion parallel to the bottom glass edge when installed, unless otherwise indicated.
 - b. Glazing materials must be free from bubbles, smoke vanes, air holes, scratches and other defects, having ground and arrised edges; provide polished edges where exposed.
4. Source Quality Control:
 - a. Individual tempered glass lites installed overhead and floor-to-ceiling tempered glass lites installed adjacent to walking surfaces must be fully heat soak tested by the manufacturer or fabricator before delivery to the project site.
 - b. Other tempered glass lites may have statistical heat soak testing performed to demonstrate nickel sulfide breakage does not exceed 0.1 percent.

C. Vacuum Deposition-Coated (Sputter-Coated) Vision Glass:

1. Description: ASTM C 1376, Kind CV (coated vision – if glass can be approached within 10 feet or less) or CO (coated overhead – if distance is greater than 10 feet) as applicable; and ASTM C 1048, Kind HS (heat strengthened) or FT (fully tempered) as indicated, Condition C (other coated glass), Type I (transparent flat glass), Class 1 (clear), Quality Q3 (select glazing applications).
2. Coating: Either spectrally selective or hybrid low-emissivity coating (low-E coating) scheduled at the end of this Section.

D. Laminated Glass:

1. Description: ASTM C 1172, Kind LA (laminated annealed), Kind LHS (laminated heat strengthened), or Kind LT (laminated fully tempered) as scheduled.
2. Glass Panes: Design Selections indicated on the Drawings or selected by the Architect, or equal.

3. PVB Interlayer:
 - a. Product: "Saflex" manufactured by Eastman Chemical Co. or "Butacite" manufactured by E.I. du Pont de Nemours & Co., Inc. (DuPont), or equal.
 - b. Opacity: Clear, translucent white (either acid etch or simulated sandblast), or opaque white interlayer indicated on the Drawings or selected by the Architect.
 4. Ionoplast Interlayer:
 - a. Product: "SentryGlas Plus" manufactured by E.I. du Pont de Nemours & Co., Inc. (DuPont), or equal.
 - b. Color: Clear or translucent interlayer indicated on the Drawings or selected by the Architect.
 5. Fabrication: Glass must conform to the requirements of ASTM C 1172, "*Standard Specification for Laminated Architectural Flat Glass*". Fabricate laminated glass free from foreign substances, and from air or glass pockets.
- E. Insulating Glass Units:
1. Description: ASTM C 2190.
 2. Glass Panes: DesignSelections indicated on the Drawings or selected by the Architect, or equal.
 3. Low-E Coating: "Solarban 60" manufactured by Vitro Architectural Glass, or equal.
 4. Interspace: Hermetically sealed air-filled interspace.
 - a. Spacer Material: Mill finish aluminum.
 - b. Spacer Corner Construction: Provide spacers and splices with no visible seams; and with soldered/welded corners.
 - c. Desiccant: Either molecular sieve or silica gel, or a blend of both, provided on all four sides.
 5. Seals: Black polyisobutylene primary sealant; black silicone secondary sealant.
 6. Edge Deletion: To promote full adhesion of primary sealant, low "E" coatings at the glass perimeter must be removed before fabrication, as required, recommended, authorized, sanctioned, or accepted by the manufacturer.
 7. Fabrication: IGU assemblies conforming to IGMA publication TB-3000, "*North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use*".
- F. Window Sills and Stools: DesignSelections indicated on the Drawings or selected by the Architect, or equal.

2.5 ACCESSORIES

- A. Butt-Glazed Partition Top and Bottom Shoes:
1. Description: Wide U-channel base with top load roll-in glazing gasket.
 2. Product: "NH3 Series" manufactured by C.R. Laurence, or equal.
 3. Material and Finish: Brushed stainless steel (BSCL).
- B. Windscreen Shoe:
1. Description: Square Base Shoe for 1/2-inch glass.
 2. Product: "Catalog No. 8B10D" manufactured by C.R. Laurence, or equal.
 3. Finish: Mill finish aluminum.
- C. Spacer Shims: Continuous shims fabricated from load-bearing, non-leaching, high-impact polystyrene.

- D. Setting Blocks, Spacers and End Blocks: Provide the following, unless another type, hardness, class, or surface is supplied, required, recommended, authorized, sanctioned, or accepted by the glass installer.
 - 1. Setting Blocks: Elastomeric silicone rubber conforming to ASTM C 1115, CH9.
 - 2. Spacers for Structural Silicone Glazing: Elastomeric silicone rubber conforming to ASTM C 1115, CH6S1.
- E. Glazing Gaskets: Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
 - 1. Firm, Dense Gaskets: Elastomeric silicone or EPDM rubber conforming to ASTM C 1115, CH7S2 unless another type, hardness, class or surface is supplied, required, recommended, approved, or accepted by the glass installer.
 - 2. Soft, Closed Cell Gaskets: ASTM C 509. Provide silicone or EPDM rubber with pre-molded corners.
- F. Backer Rod for Butt Joints: Square bi-cellular backer rod; color matching silicone sealant.
- G. Cleaners, Primers, Sealers: Supplied, required, recommended, or accepted by the manufacturer or fabricator.
- H. Other Accessories: Provide other accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:

1. Install glazing using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 2. Set glazing true to line; plumb, level, and square without warp or rack; with flush, well-fitted joints; and in alignment with adjacent construction.
 3. Completed work must match approved samples and mockups, as accepted by the Architect.
 4. Installed glazing must be warrantable. Do not install, correct, or replace glazing in a manner that is un-warrantable by the manufacturer; or that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach glazing to supporting construction.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean all visible glazing surfaces in a manner that does not result in any warranty or guarantee becoming void. Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed glazing in place from deterioration and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed glazing unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed glazing surfaces as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 08 81 00

SECTION 09 05 16 – PREPARATION OF CONCRETE SUBSTRATES FOR FINISH FLOORING

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete substrate testing equipment.
 - 2. Corrective (remedial) MVECS.
 - 3. Surface preparation.
 - 4. Site tests and inspections.
 - 5. Supplementary components, accessories, and detail work normally furnished or otherwise necessary for complete testing and preparation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 03 35 10 for preventative (day-of-pour) MVECS; for definitions of the term “recently-cured”, “hardened”, “newly-aged”, and “existing” concrete; and for wet concrete RH meter accessories.
 - 2. Section 03 54 16 for definition of the term “underlayment”.
 - 3. Section 09 29 00 for definition of “permanent enclosure”.

1.2 RELATED DOCUMENTS

- A. This specification section
 - 1. supplements the requirements of specification sections that identify penetrants, overlays, and coverings required for the project; and
 - 2. is used with other specification sections to produce correct and complete substrates for all actual in-service flooring conditions applicable to the project; and sound substrates for the proper and warrantable installation of all specified or selected penetrants, overlays, and coverings, including underlayment specified in Section 03 54 16.

1.3 PRICE AND PAYMENT PROCEDURES

- A. Slab Remediation:
 - 1. Without reimbursement from Owner, perform or arrange and pay costs for performing all remedial work necessary to correct and improve
 - a. defective flatwork, including areas that exceed the MVER, pH, and RH limits required, recommended, or accepted by the penetrant, overlay, and covering manufacturers; and
 - b. penetrant, overlay, and covering failures resulting from selected concrete curing methods; and coordination of, or failure to coordinate, the chemical and adhesive compatibility of selected curing compounds with all subsequent penetrants, overlays, and covering materials, including primers, adhesives, and sealants, and other installation materials.
 - 2. For other applications, specified MVECS is excluded from the Contract and used only as a topical remediation where necessary to conform to the penetrant, overlay, and covering manufacturers’ MVER, pH, and RH requirements.
- B. Unit Prices:

1. Administrative Requirements:
 - a. Supply unit prices in terms of dollars per square foot for complete MVECS surface preparation and installation.
 - b. Specified MVECS becomes part of the Contract upon acceptance in writing by the Owner via properly-executed Change Order.
 2. Measurement Procedures: Contract adjustments are made based on the net installed verifiable quantities of conforming work compared to quantities indicated on the Drawings.
 3. Payment Procedures:
 - a. The Owner provides payment based on actual quantities and measurements that are both placed in the work and verified by the Architect.
 - b. The Owner is not required to provide additional compensation for extraneous, non-conforming, or rejected work
- C. Alternates: With input from the preventative (day-of-pour) MVECS manufacturer, preventative MVECS specified in Section 03 35 10 may be considered for certain concrete curing applications in lieu of curing compounds; and possibly in lieu of corrective MVECS products specified in this specification section.

1.4 REFERENCES

- A. Abbreviations and Acronyms:
1. CC: Anhydrous Calcium Chloride.
 2. ICRI: International Concrete Repair Institute.
 3. MVECS: Moisture Vapor Emission Control System.
 4. MVER: Moisture Vapor Emission Rate.
 5. pH: Potential of Hydrogen.
 6. RH: Relative Humidity.
- B. Definitions:
1. Floor Preparation: Means to make flatwork surfaces ready to receive finish flooring and suitable for proper bonding of flooring and installation materials, including patching minor holes and saw cuts, sanding, sweeping, and cleaning of conforming substrates.
 2. Floor Repair: Means to fix or mend non-conforming substrates suffering from damage or fault, including grinding, filling, topping, and leveling activities.
 3. Moisture Vapor Emission Rate (MVER): Means the amount of moisture emitted from a substrate, expressed as the weight of condensed gas (liquid) in theoretical pounds emitted over 1,000 square feet of floor area during a 24-hour period. MVER is commonly referred to as “pounds” (i.e., “3 pounds” or “3 lb”). Rates range from 0 to 30 pounds per 1,000 square feet per 24 hours.
 4. Substrate: Means a recently-cured, hardened, newly-aged, or existing concrete substrate, including cast-in-place, sitecast, and precast concrete floor and deck assemblies, cast underlayment, toppings, repair materials, and similar items.
 - a. Floor: Means a slab-on-grade floor assembly.
 - b. Deck: Means a suspended floor or roof slab assembly.
 5. Penetrant: Means any direct-applied material, product, component, accessory, or other item that can pass into or through substrate surfaces, or enter and diffuse through substrate surface cracks, pores, and other surface defects. Penetrants include water, hardeners, curing compounds, stains, penetrating repellents and sealers, non-sacrificial graffiti-resistant materials, and dry penetrants.

6. Overlay: Means any direct-applied film-forming or high-build material that covers a substrate surface, including cast decks, underlayment, and toppings; dampproofing, waterproofing, and roofing; liquid flashings and sealants; fluid-applied and flooring treatment; terrazzo flooring; and paints, coatings, and film-forming sealers; and sacrificial graffiti-resistant materials.
7. Covering: Means any direct-applied material, product, component, accessory, or other item that is adhered or bonded to a substrate surface, including tile and adhered veneer assemblies; specialty, masonry, wood, resilient and precast terrazzo flooring; carpeting; and unit paving.
8. Cladding: Means any material, product, component, accessory, or other item supported by a framework, which is attached to a sporting construction, including anchored veneer, wall and soffit panels, and exterior plaster assemblies; suspended ceiling assemblies; and free-standing elevated accessible floor and roof paver assemblies.
9. Overburden: Means all materials, components, accessories, and other items installed or placed over a cured substrate, including overlays, coverings, cladding, and vegetated plaza deck and roof assemblies.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting:

1. MVECS manufacturer's representative and MVECS installer must attend the preinstallation meeting specified in specification section 03 35 10.
2. Schedule a separate additional preinstallation meeting between the Contractor, the Architect, penetrant, overlay and covering manufacturers' representatives and installers, the MVECS manufacturer's representative and installer, and the entities and individuals responsible for conducting concrete substrate testing.
3. Hold the meeting after submittal approval and at least 10 business days before beginning installation.
4. During the meeting, review
 - a. substrate design and installation, including concrete mix design, water-cement ratio, slab thickness at each test location, below grade VDRs and concrete placement and pour dates;
 - b. curing, sealing, or bond breaking compounds used on substrates, along with requirements and techniques used for complete removal of compounds prior to testing and floor covering installation;
 - c. trenching, including mix design, water-cement ratio, thickness, and pour dates of concrete or slurry backfill;
 - d. bonding agents selected for overlay installation or application;
 - e. primers and adhesives selected for covering installation;
 - f. qualifications of the testing agency and testing agency personnel that are scheduled to complete testing, and that interpret test results;
 - g. calibration and verification of test equipment prior to beginning each round of testing;
 - h. HVAC system operation and requirements during testing, including temperature and RH limits;
 - i. preparation of testing sites, including procedures to assure slab surfaces are free from any material or substance that may hinder the free release of moisture from the slab;
 - j. testing procedures and sequence for each test, including sequence, frequency, and location of test sites;

- k. requirements for testing and inspection reports;
 - l. the construction schedule;
 - m. temporary procedures required to protect concrete surfaces from re-wetting after initial testing; and
 - n. redistribution of moisture within the substrate after floor coverings are applied;
 - 5. Identify and discuss adverse or unfavorable conditions detrimental to testing and floor preparation.
 - 6. Finalize construction schedule.
 - 7. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.
- B. Quality Standards:
- 1. Quality Guideline: Selected concrete surface profiling, preparation, cleaning, and repair must conform to the requirements of International Concrete Repair Institute (ICRI) Guideline No. 310.2R, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair".
 - 2. Installation Standard: Concrete surface preparation must conform to the requirements of Journal of Protective Coatings and Linings (JPCL) publication, "Surface Preparation of Concrete Substrates".
- C. Qualifications:
- 1. Substrate Testing: Individuals performing substrate testing must be certified as ICRI Concrete Slab Moisture Testing Technicians, Grade 1 and current in their certification.
 - 2. Substrate Repair: Individuals performing substrate repair must be certified as ICRI Concrete Surface Repair Technicians, Grade 1 and current in their certification.
- D. Sequencing: Begin substrate testing only after
- 1. the building is enclosed with a permanent enclosure, including permanently- installed doors, windows, storefronts, curtain walls and similar opening protectives;
 - 2. "wet work" such as concrete work, plastering, tile installation, and gypsum board finishing are complete and cured and dried to a condition of equilibrium;
 - 3. testing areas are properly prepared for testing; and
 - 4. the HVAC system is activated, operating, and maintaining temperatures and RH at anticipated occupancy levels for at least 48 hours prior to and during testing.
 - a. If HVAC activation and operation prior to testing cannot be provided within the proposed construction schedule, then close a number of rooms or spaces where conditions can either be brought to anticipated normal conditions or into conformance with the minimum environmental parameters of the specified test standards using commercial equipment and building climate control services.
 - b. Provide a recording hygrometer to monitor and record ambient temperature and RH levels for comparison to design occupancy conditions.
- E. Scheduling:
- 1. Allow sufficient time in the construction schedule to permit concrete to cure and dry, without being re-wetted, for at least 90 days before beginning testing. Substrates re-wetted after initial curing must be permitted to cure and dry for at least 180 days before beginning testing.
 - a. If minimum concrete curing and drying time cannot be provided in the construction schedule, assume the specified MVECS must be incorporated into the project as a topical remediation for concrete substrates, and reflect this assumption in the project cost until otherwise directed by the Owner.

- b. Forced drying substrates is prohibited.
2. Allow sufficient time in the construction schedule to permit RH test sites to equalize for at least 72 hours prior to reading equilibrium RH levels.
3. Testing must be complete and reports submitted at least one week, but not more than 3 weeks, before beginning penetrant, overlay, or covering installation or application.

1.6 SUBMITTALS

- A. Action Submittals: Before beginning the work of this specification section, including bulk purchase and delivery of products, submit to the Architect the following for responsive action (formal review and approval).
 1. Product Data:
 - a. Submit manufacturer's product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
- B. Informational Submittals: Submit to the Architect the following for information (for informal review: responsive action by the Architect, including formal review and approval, is not expected or required, except to record non-conformance with specified requirements).
 1. Installation Instructions: Before beginning the work of this specification section, submit the following.
 - a. Submit manufacturer-prepared published instructions for the proper installation of each furnished manufactured item and accessory, including packaging, delivery, storage, handling, surface preparation, installation, adjusting, cleaning, and protection instructions and requirements.
 - b. If manufacturer-prepared published installation instructions are either unavailable or do not specifically apply to actual project conditions, then consult with the manufacturer's representative and obtain manufacturer-prepared, project-specific supplemental instructions printed on the manufacturer's company letterhead. Promptly distribute copies to the Architect for examination before beginning the work of this specification section; the Architect may have comments that lead to contract modifications, or to minor changes in the work.
 2. Test Reports: Submit facility floor plan diagrams showing area calculations and locations of each test along with measured test results for each test location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Provide products manufactured by one of the following, or equal.
 1. American Moisture Test, Inc.
 2. Vaisala
 3. Wagner Electronics.

2.2 CONCRETE SUBSTRATE TESTING EQUIPMENT

- A. Description: Commercially produced and -packaged test kits and equipment delivered to testing sites in factory-sealed wrappings.
- B. MVER Testing Kits (CC Moisture Test Kits):
 - 1. Description: ASTM F 1869-compliant anhydrous calcium chloride moisture vapor testing kits consisting of a sealed dish of anhydrous calcium chloride, a metering dome with gasket, and instructions.
 - 2. Product: “AMT Calcium Chloride Moisture Test Kit” manufactured by American Moisture Test, Inc., or equal.
 - 3. Components:
 - a. Non-pre-weighed, non-recycled, 94-percent pure anhydrous calcium chloride sealed in air-tight dishes.
 - b. Virgin resin non-recycled plastic dome having a maximum U.S. perm rating of 0.10-perm or less.
 - c. Butyl adhesive sealant system.
 - d. Dish container size of 69mm plus or minus one millimeter; calcium chloride weight of 16 grams plus or minus one gram.
- C. pH Testing Kits:
 - 1. Description: ASTM F 710-compliant digital alkalinity-pH meter.
 - 2. Product: “AMT Concrete Digital Alkalinity-pH Meter” manufactured by American Moisture Test, Inc., or equal.
 - 3. Components:
 - a. Meter must return wide range (1-14) pH readings.
 - b. Provide clean distilled or deionized water.
- D. RH Testing Equipment:
 - 1. Description: ASTM F 2170-compliant temperature and RH meter, cable, RH probes, and concrete sleeves.
 - 2. Product: “AMT RH System” manufactured by American Moisture Test, Inc., or equal.

2.3 CORRECTIVE (REMEDIAL) MVECS

- A. Description: Corrective MVER remediation system consisting of concrete mechanical surface profiling, sealer, and cementitious covering.
- B. Application: MVER remediation system are applied when test results indicate slab MVER, pH, or RH exceed selected coating or covering manufacturer’s required, recommended, or accepted limits.
- C. Concrete Surface Profiling: ICRI concrete surface profile CSP 2 to CSP 3 (grind to light blast between 4 and 10 mils), unless otherwise explicitly required, recommended, accepted in writing by the sealer manufacturer.
- D. Sealer:
 - 1. Description: Moisture seal applied to substrates as a topical remediation.
 - 2. Products: “MES 100” manufactured by Floor Seal Technology, Inc., or equal.
 - 3. Requisite Properties:

- a. Composition: Products may not contain latex, organic additives or chemistries that have a potential to either re-emulsify or support micro-organism growth.
- b. Growth Resistance: Product must not support the growth of mold, mildew or biological growth.
- c. Safety: Non-corrosive, non-toxic, and non-hazardous to installers.
- d. Water Pollution: Product must be a non-marine pollutant, and safe for natural water sources.
- e. Maximum VOC Material Content: Less than 100 grams per liter.
- 4. Performance Requirements:
 - a. Water Vapor Transmission: Products must bring emission rates of up to 20 pounds to within a range conforming to the flooring manufactures' requirements, when measured in conformance with ASTM F 1869.
 - b. Alkali Resistance: Tolerant to 14pH alkali exposure, when tested in conformance with ASTM D 1308 and ASTM F 710.
 - c. Minimum Adhesion Strength: Between 370 and 500 pounds per square inch, when tested in conformance with ASTM D 4541.
 - d. Adhesive Compatibility: Complete compatibility with all covering primers, adhesive, and materials.
 - e. Minimum RH Tolerance: Tolerant to at least 95 percent RH exposure, when determined in conformance with ASTM F 2170.
- E. Fabricators: Provide products fabricated by one of the following, or equal.
 - 1. Description: Cementitious topping applied directly over sealer to provide smooth substrate for finish flooring.
 - 2. Products: Hydraulic cement underlayment specified in Section 03 54 16.
 - 3. Minimum Thickness: Install underlayment to thickness required by either the sealer manufacturer or the finish flooring manufacturer (whichever is thicker), but not less than 1/8-inch.

2.4 ACCESSORIES

- A. Trowelable Patch and Fill Materials: Specified in Section 03 54 16 unless other products are supplied, required, recommended, or accepted by the manufacturer for actual in- service conditions applicable to the project.
- B. Other Accessories: Provide accessories and other similar secondary items supplied, required, recommended, or accepted by the MVECS manufacturer.

2.5 SURFACE PREPARATION

- A. Penetrants:
 - 1. Remove all dirt, dust, debris, and other foreign matter from concrete surfaces
- B. Marker Removal:
 - 1. Remove all slab markings by sanding or bead blasting surface clean.
 - 2. Completely remove all marker markings (i.e. Sharpie markers), marker paint, spray paint, and other markings.
- C. Floor Coatings and Fluid-Applied Flooring:

1. Provide one or more of the following ICRI concrete surface profiles, as applicable, unless otherwise explicitly required, recommended, or accepted in writing by the flooring manufacturer.
 - a. Sealers: CSP 1 to CSP 2. (grind to between 0 and 3 mils)
 - b. Thin-Film Coatings: CSP 2 to CSP 3. (grind to light blast between 4 and 10 mils)
 - c. High-Build Coatings and Resurfacing Applications: CSP 3 to CSP 5. (light to medium shotblast between 10 and 40 mils)
 - d. Self-Leveling Overlays: CSP 4 to CSP 6. (medium to heavy shotblast between 50 mils and 1/8-inch)
 - e. Polymer Overlays: CSP 5 to CSP 9. (medium shotblast to coarse planing between 1/8- and 1/4- inch)
 - f. Concrete Overlays, Toppings, and Repairs: CSP 5 to CSP 10. (medium shotblast to coarse planing greater than 1/4- inch)
2. To reduce the risk of introducing microcracking into the substrate, all concrete surface profiling must be achieved through abrasive blasting, grinding, or shot blasting; or through the use of surface retarders specified in Section 03 35 10.
 - a. Handheld concrete breakers, rotomilling, needle scaling, scabbling, and scarifying are prohibited, unless explicitly required or recommended in writing by the covering manufacturer (scarifying grooves/lines may become visible through a newly laid coverings).
 - b. Ultra-high- and high-pressure water jetting, and low-pressure water jetting surface preparation methods are also prohibited.
 - c. Chemical cleaning and acid etching are also prohibited. (residual chemicals not removed may adversely affect the flooring performance and adhesion – ASTM D 4262 covers procedures for determining the acidity or alkalinity of concrete surfaces prepared by chemical cleaning or etching prior to coating)
3. Repair damaged sub-floor. Produce a uniform and smooth substrate. Fill cracks, holes, depressions, and similar substrate defects with trowelable leveling and patching compound; remove bumps and ridges.
4. Sweep and vacuum-clean substrates just prior to beginning floor covering installation.
5. Move floor coverings and installation materials into spaces at least 48 before installation.

D. Floor Coverings: Prepare substrates in conformance with the requirements of

- E. ASTM F 710 and as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives or that contain soap, wax, oil, or silicone; or that may negatively affect the quality of installation, durability, appearance, or performance of furnished flooring. Comply with the flooring manufacturers' instructions using manufacturer- recommended techniques and equipment. Do not use solvents.
 3. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with leveling and patching compound. Apply, trowel, and float patching compound to achieve smooth, flat, hard surface. Prohibit traffic until patching compound is cured.
 4. Repair damaged sub-floor. Produce a uniform and smooth substrate. Fill cracks, holes, depressions, and similar substrate defects with trowelable leveling and patching compound; remove bumps and ridges.
 5. Sweep and vacuum-clean substrates just prior to beginning floor covering installation.

6. Do not install floor coverings until both they and the installation materials are acclimated to the same temperatures as the spaces into which they are installed. Move floor coverings and installation materials into spaces at least 48 before installation.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verification of Conditions: Before beginning testing, examine project conditions and field-verify measurements affecting the work of this specification section.
 1. Examine substrates scheduled for testing, and other conditions under which such items are tested, including HVAC operation and building enclosure.
 2. Verify that work performed as part of the work of other specification sections conforms to the testing equipment or testing kit manufacturer's requirements; and satisfies all other conditions relating to the quality of testing.

3.2 FIELD QUALITY CONTROL

- A. Site Tests and Inspections:
 1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections.
 - a. Schedule and arrange all tests and inspections.
 - b. Coordinate all work and the final construction schedule with all tests and inspections.
 - c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections.
 - d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection.
 - e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection.
 - f. Witness all site tests and inspections.
 - g. Receive test and inspection reports and distribute to the installer and the manufacturer's representative.
 - h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections.
 2. Required Tests: Conduct the following tests on all concrete substrates prior to the installation of any flooring material or component regardless of substrate grade level or age.
 - a. MVER Testing (Anhydrous Calcium Chloride Test): Conduct CC tests in conformance with ASTM F 1869.
 - 1) Test area environmental conditions must match that of the finished floor covering.
 - 2) Doors, windows, and roofing must be installed and the building temperature controlled to a finished building atmosphere.
 - 3) Do not perform tests when the interior building temperature is below 65 deg. F for 72 hours prior to and throughout the duration of testing.

- 4) The minimum required number of test kits is determined by the square footage of areas scheduled to receive finish flooring. Provide at least 3 test kits for the first 1,000 square feet, and at least one additional test kit for each additional 1,000 square feet or fraction thereof, with consideration given to separation of test areas.
 - 5) Time of exposure must be between 60 hours 72 hours.
 - 6) Clean substrate in area to be tested by removing dust solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation, or laitance, mold mildew and other foreign materials.
 - 7) Weigh the tape sealed dish on a gram scale with 1/10th gram gradation. Record start weight, date and time on dish's label and instruction document.
 - 8) Unseal dish and expose test according to preprinted test kit instructions.
 - 9) After exposure time has elapsed, retrieve test dish re-seal and re-weigh according to the manufacturer's instructions.
 - 10) Moisture emission rates exceeding 3 pounds may affect coating or covering. Verify permissible RH levels with individual flooring manufacturers.
- b. Alkalinity (pH) Testing: Conduct pH test in conformance with ASTM F 710.
- 1) Perform tests after abrasive removal of concrete surfaces.
 - 2) Place several drops of water on a clean portion of the substrate surface; form a puddle approximately one-inch in diameter. Allow the puddle to set for at least 60 seconds, and then insert the digital alkalinity-pH meter probe into the puddle. Allow the meter to calculate results for 15 seconds and record the meter readings.
 - 3) Concrete substrates must test between pH 8.0 and 10.0 before flooring materials are installed; slabs may not exceed pH 10.0.
 - 4) Readings exceeding pH 10.0 may affect coating or covering. Verify permissible pH levels with individual flooring manufacturers.
- c. RH Probe Test: Conduct in situ RH probe testing in conformance with ASTM F 2170
- 1) Concrete floor slabs must be at the in-service temperature and the occupied air space above the slab must be at the in-service temperature and RH for at least 48 hours before taking RH measurements in the substrate.
 - 2) Perform at least 3 tests for the first 1,000 square feet and at least one test for every additional 1,000 square feet or fraction thereof.
 - 3) At below-grade substrates, choose testing locations within 3 feet of each exterior wall.
 - 4) Drill probe holes 40 percent down into the slab for slabs drying from the top only; 20 percent into the slab for slabs drying from top and bottom.
 - 5) Use a vacuum cleaner to remove dust from drilled holes, and allow at least 72 hours for holes to achieve moisture equilibrium within each hole before taking RH measurements.
 - 6) After the 72-hour equilibrium period, insert probes and allow a 30-minute period for each probe to reach temperature equilibrium before measuring RH.
 - 7) Use the RH probe to measure the ambient air temperature and RH above the slab in the vicinity of the hole.
 - 8) RH readings exceeding 75 percent may affect coating or covering. Verify permissible RH levels with individual flooring manufacturers.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

END OF SECTION 09 05 16

SECTION 09 22 26 – METAL SUSPENSION SYSTEMS

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal furring and framing systems for supporting suspended gypsum board ceilings.
 - 2. Delegated design of metal furring and framing assemblies.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. BMT: Base Metal Thickness.msg
 - 2. MSG: Manufacturer's Standard Gage for Sheet Steel.
 - 3. HDG: Hot Dip Galvanized.
- B. Definitions:
 - 1. Manufacturer: Means the metal suspension system manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Delegated Design Requirements:
 - 1. Where engineering is required, including when manufacturer's loading tables are exceeded, engineer, fabricate, assemble, and install suspension systems that conform to the profiles indicated and other Contract Document requirements; meet specified performance criteria; and result in structurally sound, and non-corroding assemblies that accommodate, resist, distribute, or transfer in-service loads without incipient or catastrophic failure.
 - 2. Maintain visual design concept indicated, including sizes, profiles, and alignments. Deviation from visual design concept is non-conforming work and prohibited without prior written acceptance by the Architect.
- B. Performance Requirements:
 - 1. Superstructure Deflection and Story Drift: Accommodate design displacement of adjacent stories indicated on the structural drawings.
 - 2. Seismic Loads: Resist, distribute, or transfer seismic loads indicated on the structural drawings without incipient or catastrophic failure.
 - 3. Perpendicular Deflection (Convexity and Concavity): Drywall support system may not deflect more than L/240, measured normal to the assembly plane.
- C. Acoustic Requirements: Where materials are part of an STC-rated assembly, provide items within the assembly that are identical to or better than those products indicated as listed and tested in conformance with ASTM E 90 and ATM E 413.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Delegated Design Submittals: Together with shop drawings, submit engineering calculations demonstrating conformance to the Contract Documents and all impacts of delegated design scope of work on other work.
 - a. Calculations must be explicit and legible and must incorporate distinct cross-references to submitted shop drawings in sufficient quantity to render the calculations readily intelligible and reviewable.
 - b. At a minimum, calculations must include design loads; analysis of supporting construction, including section-property computations; analysis of fasteners, anchors, attachments, and connectors; and signature and seal of the licensed professional engineer responsible for preparing them.
 - c. Test reports are not an acceptable substitute for calculations and are returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Suspension system components must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in-service conditions applicable to the project.
- B. Quality Standards:
 - 1. Comply with all requirements of the International Building Code (IBC).
- C. Qualifications:

1. Installer: Company or individuals must have at least 5 years' experience installing suspension systems for at least 30 previous projects similar to this project in size, material, design, and complexity.
2. Supervisors: Individuals must have at least 7 years' experience installing suspension systems for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading suspension system installers.
3. Engineer: Must be a licensed professional structural engineer registered to practice in Massachusetts having at least 10 years' experience performing the kind of engineering services indicated for at least 20 previous projects similar to this project in size, material, design, and complexity.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
 1. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage.
 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 4. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to other sources of deterioration and damage.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective suspension system components with undamaged new suspension system components that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Provide products manufactured by one of the following, or equal.
 1. California Expanded Metal Products Co. (CEMCO)

2. ClarkDietrich Building Systems.
3. Olmar Supply Inc.
4. SCAFCO Corp.

2.2 MATERIALS

- A. Cold-Formed Metal Framing: ASTM A 1003, ST50 (Structural Grade 50), with at least a G60 coating weight designation (mass designation) on both surfaces with equal coating weight on each surface.
- B. Lightgauge Metal Framing: ASTM C 645 manufactured from HDG metallic-coated steel sheet conforming to ASTM A 1003, NS33 (Non-Structural Grade 33), with at least a G40 coating weight designation (mass designation) on both surfaces with equal coating weight on each surface.

2.3 COMPONENTS

- A. Galvanized Carbon Steel Wire:
 1. Hanger Wire: At least 0.162-inch diameter (SWG 8).
 2. Diagonal Bracing Wire: At least 0.106-inch diameter (SWG 12).
 3. Tie Wire: At least 0.050-inch diameter (SWG 18).
- B. Standard Furring Clips:
 1. Application: Used in lieu of tie wire to attach metal furring channels to 1-1/2-inch U-channels in drop ceiling assemblies.
 2. Restrictions:
 - a. Clips must be installed on alternating sides of carrying channels. Use tie wire when clips cannot be alternated.
 - b. Clips must only be used when single-layer gypsum or single-layer veneer plaster base is used. Otherwise use tie wire.
 3. Product: “Metal Furring Channel Clips (MFCC)” manufactured by Clarkwestern Dietrich Building Systems LLC, or equal.
- C. Resilient Sound Isolation Furring Clips:
 1. Application: Used in lieu of tie wire to attach metal furring channels to 1-1/2-inch U-channels in drop ceiling assemblies.
 2. Restrictions:
 - a. Clips must be installed on alternating sides of the 1-1/2-inch channels. Use tie wire when clips cannot be alternated.
 - b. Clips must only be used when single-layer gypsum or single-layer veneer plaster base is used. Otherwise use tie wire.
 - c. Carrying channels (U-channels) may not exceed 48-inch on center spacing.
 - d. Furring channels (hat channel) may not exceed 24-inch on center spacing.
 3. Product: “GenieClip C3” manufactured by Pliteq Inc., or equal.
- D. Flat Hangers (Straps):
 1. Width: At least 2 inches.
 2. Minimum Thickness: At least 97 mils BMT (MSG 12).

- E. U-Channel or Cold Rolled Channel (CRC) Carrying Channels:
 - 1. Deep: 3/4- or 1-1/2-inches.
 - 2. Minimum Thickness: At least 97 mils BMT (MSG 12).
 - 3. Flanges: 1/2 inch wide.
- F. Hat Furring Channels:
 - 1. Products: “Hat” or “F” furring channel manufactured by CEMCO, or equal.
 - 2. Depth: 7/8- or 1-1/2-inch deep, as indicated.
 - 3. Minimum Thickness: At least 30 mils BMT (MSG 20).
 - 4. Web: 1-1/4 inches wide or 2-1/2 inches.
 - 5. Screw Flanges: 1/2-inch wide.

2.4 ACCESSORIES

- A. Attachment Devices: Sized for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
- B. Seismic Separation Joints: Provide seismic separation joints at ceiling locations where the contiguous area of non-broken ceiling is 2,500 square feet or greater.
- C. Compression Struts:
 - 1. Cold or hot rolled angles, loadbearing or non-loadbearing studs, EMT or rigid conduit, or black iron.
 - 2. Cold-rolled steel section with maximum L/R ratio of 200.
- D. Screw Fasteners: Provide #8-32 UNC 2B (0.164-inch shank diameter, 32 threads per inch) by at least one-inch long, pan head, coarse thread, self-piercing or self-drilling as applicable, chromate finish zinc-plated steel screw fasteners, unless another fastener type is explicitly indicated; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- E. Power-Actuated Fasteners:
 - 1. Description: ICC-ES-approved anchors conforming to International Building Code, unless a more stringent Occupancy Category or Seismic Design Category is indicated on the Structural Drawings.
- F. Manufacturer: Provide products manufactured by Hilti, Inc., or equal.
- G. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- H. Other Accessories: Provide other accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install suspension systems using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Installed suspension systems must be warrantable. Do not install, correct, or replace suspension systems in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach suspension systems to supporting construction.
- C. Installation Tolerances: Install suspension systems within the following tolerance variations.
 - 1. Maximum Out of Plane: Surfaces may not vary by more than 1/8-inch in 10 feet.
 - 2. Carrying Channel Maximum Out of Level: Not more than 1/8-inch in 12 feet,
 - 3. Main Runner Maximum Out of Level: Not more than 1/4-inch in 10 feet,
 - 4. Main Runner Maximum Deflection: Not more than L/360 of span,
 - 5. Maximum Misalignment of Main Runners: 0.015-inch.
 - 6. Maximum Misalignment of Intersection Members: 0.020-inch.
 - 7. Main Runner Bow, Camber, and Twist: Not more than 1/32-inch in 2 feet bow or camber; not more than one degree twist.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.

- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

END OF SECTION 09 22 26

SECTION 09 22 38 – CEMENT PLASTER BASE

1.1 SUMMARY

- A. Section Includes:
 - 1. Cementitious scratch and brown coats.
 - 2. Supporting framework.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. AR: Alkali Resistant.
- B. Definitions:
 - 1. Manufacturer: Means the plaster manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting:
 - 1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 - 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation
 - 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed plaster. Resolve each condition.
 - 4. Finalize construction schedule.
 - 5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)

2. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
 3. Samples: Submit at least 18-inch square representative color stepped samples of each plaster type, color, finish with typical trim and joints intersecting at the center of each sample. Stepped samples must include each coat or layer, including prime coat, separately identified by manufacturer's name, and product name or stock number.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished plaster.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
1. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Plaster must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Qualifications:
1. Installer: Company or individuals must have at least 5 years' experience installing plaster for at least 30 previous projects similar to this project in size, material, design, and complexity.
 2. Supervisors: Individuals must have at least 7 years' experience installing plaster for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading plaster installers.
- C. Mockups: If an ex-situ exterior wall integrated mockup is required for this project, then integrate plaster into the mockup as part of the work of this specification section.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage during storage.
 - 1. Prevent stored items from contacting the floor or ground and from deterioration and damage.
 - 2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited. (due to potential accumulation of moisture beneath tarpaulin during certain environmental conditions)
 - 3. Incline covered items to ensure maximum drainage of accumulated moisture.
 - 4. Do not leave items uncovered where they might be exposed to weather or become wet from rain, mist, relative humidity, condensation, frost, and other sources of moisture; or exposed to other sources of deterioration and damage, including heat and sudden changes in temperature, and UV exposure beyond manufacturer- recommended limits.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
 - 1. Avoid damage to packaging and containers, and contamination of contents.
 - 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective plastering materials with undamaged new plastering materials that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install plaster only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Other Conditions:
 - 1. Substrate Tolerance: Surfaces receiving plaster finishes must be flat with 1/4-inch within any 10-foot radius.
 - 2. Deflection: Maximum of substrate deflection under positive or negative design loads must not exceed L/360 of span.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 5 years.
- B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 SUPPORTING FRAMEWORK

- A. Heavy-Duty Welded Wire Lath:
 - 1. Description: Self-furring galvanized steel welded wire fabric lath fabricated in conformance with the requirements of ASTM C 847, ASTM C 933, ASTM C1032, ASTM C1063 and Appendix.
 - 2. Application: Fabricated for use as an alternative to 2.5 or 3.4 pound per square yard diamond mesh metal lath specified in ASTM C 847 and as an alternative to 1.4 pound per square yard woven wire lath specified in ASTM C 1032.
 - 3. Product: “Mega Lath” manufactured by Structa Wire Corp. (ICC-ES Report No. ESR-2017), or equal.
 - 4. Requisite Properties:
 - a. Minimum Size: 30 inches wide by 108-foot long rolls. (30 square yards)
 - b. Wire and Mesh Sizes: 17-gage galvanized steel wire welded to form 0.7-inch by 1.5-inch openings.
 - c. Nominal Weight: 1.95 pounds per square yard.
 - d. Style: Self-furring.
 - e. Minimum Groove Depth: At least 1/4-inch
- B. Galvanized Steel Trim:
 - 1. Description: Zinc coated (HDG) steel trim conforming to ASTM C 847, ASTM C 933, ASTM C1032, ASTM C1063 and Appendix.
 - 2. Manufacturers: Provide products manufactured by one of the following, or equal.
 - a. California Expanded Metal Products Co. (CEMCO)
 - b. Clarkwestern Dietrich Building Systems LLC.
 - c. Fry Reglet.
 - d. Stockton Products.
 - 3. Products: “Water Management Products” manufactured by California Expanded Metals Co. (CEMCO), or equal.
 - a. Foundation Weep Screeds: “#7 Foundation Sill Screed (FHA Screed)”, or equal, with at least a 3-1/2-inch flange and weep holes.
 - b. Extended Weep Screed: “#7 Extended Foundation Screed”, or equal, one-piece flashing weep screed for applications at decks where flashing is needed to protect waterproof membrane.

- c. Base Flashing: “#17 Base Flashing”, or equal, one-piece flashing weep screed for applications at decks where flashing is needed to protect waterproof membrane.
 - d. Drip Head: “#6 Drip Head”, or equal, for application above vents, doors, windows, joints, and as indicated on the Drawing; water can weep out of the slope leg and solid return leg used for sealant application.
 - e. Drip Edge: “#12 Soffit Drip Edge”, or equal, used at soffits and recessed windows; provides drainage and drip edge.
 - f. Flashing Screed: “#3 Flashing Screed”, or equal, one-piece Z-flashing and weep screed combination for application at window head.
 - g. Casing Beads: “J-Series Casing Bead”, or equal, non-perforated casing bead; used as a stop to terminate plaster edge in a clear straight line at head of plaster or jamb conditions of doors, windows.
 - h. Expansion Joints: “M-SLIDE EXPANSION JOINT”, or equal; 2-piece plaster accessories are prohibited.
 - i. Horizontal Control Joint: “#15 SOLID LEG Control Joint”, or equal, one-piece horizontal control joint.
 - j. Vertical Control Joints: “#XJ15 Expanded Wing Control Joint (Double J)”, or equal, used to relieve stresses in large plastered areas of walls, ceilings and plaster areas.
 - k. Transition Control Joint: “#9 Transition Control Joint”, or equal, one-piece drainage accessory for application at substrate transitions between masonry and framed walls.
 - l. Control Joints: “#15 Double V Control Joint”, or equal, used to relieve stresses in large plastered areas of walls, ceilings and plaster areas.
 - m. Clean-Finish Control Joints: “#XJ15 Expanded Wing Control Joint (Double J)”, or equal, used to relieve stresses in large plastered areas of walls, ceilings and plaster areas.
 - n. Cornerbeads: “#2A-Expanded Corner Bead”, or equal, used for reinforcing exterior corners, or equal.
 - o. Cornerite: Pre-shaped diamond mesh metal lath formed with minimum 3-inch legs to minimum 105 degrees for a snug fit; used as a reinforcement on inner corners.
 - p. Strip Lath: Welded wire metal lath formed in at least 4-inch wide strips with smooth outer edges. Used where small strips of lath are required so cutting is limited; and around window and door frames as butterfly reinforcement.
4. Requisite Properties:
- a. Size: Trim and accessories depths must match the thicknesses and number of plaster coats required.
 - b. Material: Zinc Coated (HDG) Steel Sheet conforming to ASTM A 653, CS Type B (commercial steel), with at least a G90 (galvanized) minimum coating designation and equal coating weight on each surface.
 - c. Surface Finish: Provide regular spangle surface finish.
 - d. Surface Treatment: Provide oiled surface treatment. (needed for enhanced formability)

2.2 CEMENTIOUS SCRATCH AND BROWN

- A. Description: Pre-blended mixture conforming to ASTM C926, including cement, reinforcement fibers, hydrated lime, and proprietary ingredients for scratch and brown coats.
- B. Manufacturers: Provide products manufactured by one of the following, or equal.

1. Dryvit Systems, Inc.
 2. Omega Stucco.
 3. Parex USA, Inc.
 4. Sto Corp.
 5. The QUIKRETE Companies.
- C. Product: “QUIKRETE Base Coat Stucco - Pump Grade (No. 1139-86)” manufactured by The QUIKRETE Companies., or equal.
- D. Components:
1. Cement: Portland cement conforming to ASTM C 150 Type I.
 2. Fine Aggregate: Dense graded (well-graded) air dry natural sands conforming to ASTM C 897 requirements for gradation, deleterious substances and organic impurities.
 3. Hydrated Lime: ASTM C 206, Type S. (special finishing hydrated lime)
 4. Fiber Reinforcement: Nylon or polypropylene monofilament fibers conforming to ASTM C 1116 Type III. (synthetic fiber-reinforced concrete or shotcrete) AR chopped glass fiber strands are prohibited.
- E. Accessories:
1. Mix Water: Provide fresh, clean, clear, potable water from a domestic source. Water must conform to ASTM C 1602 and be free of oil, grease, waxy films, curing compounds, release agents, and other deleterious materials, including salts, acids, alkalis, organic materials, detergents, and other matter that might negatively affect plaster quality, durability, appearance, or performance.
 2. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.3 ACCESSORIES

- A. Tie Wire: At least 0.048-inch diameter (ASW 18) soft temper zinc-coated wire conforming to ASTM A 641 Class 3 or A coating.
- B. Fasteners for Concrete and CMU: At least 3/4-inch long hardened drive pin power- actuated fasteners (PAF) with 1/2-inch diameter galvanized disc or washer; or 9-gauge, minimum 3/8-inch diameter head, minimum 3/4-inch long concrete nails.
- C. Fasteners for Metal Framing: 0.164-inch shank diameter (#8-32 UNC) by at least 1-1/4- inch-long Philips drive socket, bugle or wafer head, self-drilling stainless steel, bi-metal, duplex anti-corrosive steel, 3-coat anti-corrosive steel, or ceramic-coated anti-corrosive steel screw fasteners, unless another fastener type is explicitly indicated; or is otherwise supplied, required, recommended, or accepted by the manufacturer.
- D. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.4 MIXING

- A. Factory-Mixed Products:
 - 1. Open plaster packaging and containers only as required for use and mix only in designated areas.
 - 2. Thoroughly agitate and stir plaster to a uniform and smooth consistency suitable for proper installation.
 - 3. Do not reduce, alter, or introduce foreign materials into plaster, except in conformance with manufacturer's instructions and other requirements and recommendations.
- B. Site Mixing: Batch mix plaster in conformance with manufacturer's instructions and other requirements and recommendations, using manufacturer-recommended techniques and manufacturer-recommended mechanical mixing equipment, which must be clean and free of material from previously mixed batches before charging each subsequent batch.
 - 1. Measure mix materials using only graduated mixing containers and calibrated mixing equipment. Shovels do not qualify as graduated mixing containers or calibrated equipment, and are prohibited from measuring or dispensing mix materials.
 - 2. Thoroughly agitate and stir mix materials to a uniform and smooth consistency suitable for proper installation.
 - 3. Do not reduce, alter, or introduce foreign materials into mix materials, except in conformance with manufacturer's instructions and other requirements and recommendations.
 - 4. Do not use caked or lumpy materials; or materials that are irregular, too thick or too thin, or that are partially set.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
 - 2. Verify items penetrating plaster are installed.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Protection:
 - 1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and plaster finish installation.
 - 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
 - 3. Opening Protection: Close and protect drains and other openings and penetrations to prevent intrusion or migration of liquids.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any specified or other warranty or guarantee becoming void.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Install plaster using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Securely attach plaster trim and lath in place to supporting construction. Continuous expansion and control joints must be installed at locations in conformance with ASTM C1063 and ASTM C926.
 - 3. Completed work must match approved samples and mockups, as accepted by the Architect.
 - 4. Installed plaster must be warrantable. Do not install, correct, or replace plaster in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Provide sufficient manpower and equipment to ensure a continuous operation free of cold joints, scaffold lines, texture variations, and other objectionable conditions.
 - a. Plaster surfaces full height and width between control joints in one operation once the application of any coat has begun.
 - b. Stop plaster at control joints, edges, or corners only.
 - c. Apply plaster flush with metal trim members and make corners square and true.
 - 2. Finish plaster in a true, plumb or level plane flush with grounds.
 - 3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal. Apply sealant in groove to metal frame.
 - 4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
 - 5. Protection Measures during Application and Cure:
 - a. Protect plaster products in conformance with manufacturer's instructions.
 - b. Protection measures must shield the completed scratch, brown and finish coat applications from direct sunlight and wind exposure (i.e., provide dark colored coverings or barriers).
 - c. The combination of curing and protection measures that are employed must prevent drying, uneven or excessive evaporation and strong natural or artificial blasts of dry air during the curing period.
- C. Plaster Accessory Installation:

1. Install with surfaces and edges plumb, level and in alignment with a tolerance of not more than 1/8-inch in 5 feet. Shim as required and align joints with concealed splice or tie plates.
 - a. Use single length pieces wherever length of run does not exceed longest standard stock length available.
 - b. Miter or cope at corners with hairline joints, and seal with sealant specified in Section 07 92 00. Seal butt splices in the same manner.
 - c. Attach securely to supports with same fasteners and spacing as required for metal lath. Wire-tie at no less than 6-inches-on-center to metal lath.
2. Install foundation weep screed.
3. Install corner reinforcement.
4. At plaster terminations, provide casing bead at the following locations:
 - a. Where plaster termination abuts other finishes, isolate casing bead from contact with adjacent finishes with 1/4-inch thick tape sealant specified in
 - b. Section 07 92 00.
 - c. Where plaster termination is not covered by another finish or applied trim, provide cased opening by installing casing bead around perimeter of opening as indicated.

D. Control Joint Installation:

1. Install control joints in specific locations indicated on the Drawings, approved by Architect, and as follows.
 - a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - 1) Vertical Surfaces: 144 sq. ft.
 - 2) Horizontal and Other Non-Vertical Surfaces: 100 sq. ft.
 - b. At distances between control joints of not greater than 18 feet on center
 - c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - d. Where control joints occur in surface of construction directly behind plaster.
 - e. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
2. Wire tie to metal lath at maximum 6 inches on center. Do not attach horizontal control joints to vertical control joints at intersections across the joint.
3. Install vertical control joint first, continuous from top to bottom of wall.
4. Install horizontal control joints last and split where it meets the vertical control joint.
5. Install joints plumb, level, evenly spaced, at locations and spacing indicated, and in one piece.

E. Metal Lath Installation:

1. Comply with the lath manufacturer's printed installation instructions, and with ASTM C 1063 and Appendix, and the CBC.
2. Unless otherwise indicated, install all horizontal trims, joints, and accessories prior to installing lath.
3. Apply metal lath in conformance with the manufacturer's published installation standards.
4. Apply lath taut with long dimension at right angle to supports.
5. Stagger vertical joints. Lap end joints at least one inch, and lap horizontal joints at least 1/2-inch.
6. Where end laps occur between framing members, wire-tie ends at not more than 9 inches on center.

7. Cut lath at expansion and control joint locations. Lath must be secured to expansion and control joints at each side of joints and lapped or spliced at interior and exterior corners.
 8. Hold lath 1/4-inch clear of items projecting through the plaster.
 9. Attach lath through WRB and sheathing into supporting construction at 6 inches on center.
- F. WRB Repair: Before beginning plaster installation,
1. examine exterior walls from the interior before drywall is installed to discover shiners; repair shiners; and
 2. repair tears, holes, and other damage.
- G. Scratch Coat Installation:
1. Apply with sufficient material to cover well and sufficient pressure to form good, full keys. Mix and apply scratch coat and admix and bonding agent products in conformance with manufacturer's published instructions.
 2. Minimum thickness of scratch coat shall be 3/8-inch when measured from backing to crest of scored plaster.
 3. Scratch before plaster hardens to provide sufficient mechanical key for brown coat. Moist cure continuously for a minimum of 48 hours in conformance with ASTM C 926 and building codes. Surface of the scratch coat must be dampened with fog spray prior to application of the brown coat. Do not over-saturate.
 4. Score horizontally.
- H. Brown Coat Installation:
1. Surface of the scratch coat must be dampened with fog spray prior to application of the brown coat. Do not over-saturate.
 2. Apply brown coat approximately 3/8-inch thick at a uniform thickness that matches the grounds of the accessories. Bring to a true, even surface by rodding and floating and leave slightly rough, uniform texture to receive the finish coat.
 3. Begin floating only after hydration of the cement has commenced, and sufficient moisture has evaporated so that surface sheen will disappear, but before plaster has become too rigid to be moved under the float.
 4. Moist cure continuously for at least 48 hours in conformance with ASTM C 926 and building codes, including weekends and holidays.
 - a. Specified moist curing period is a minimum requirement.
 - b. Determine the most effective procedure for curing and time lapse between applications of coats based upon climatic and job conditions.
 - c. Fog as frequently as required to prevent loss of moisture from the plaster. Avoid erosion damage to the plaster surface.
- I. Finish Coat:
1. Apply finish coat not less than 7 days after brown coat has been applied. Dampen brown coat thoroughly and apply finish coat to a uniform minimum thickness of 1/8- inch to match approved mockup. Correct irregularities prior to application.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging

all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.

- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed plaster in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything adjacent to or against installed plaster unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed plaster as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 09 22 38

SECTION 09 28 15 – GMF GYPSUM TILE BACKING BOARD

1.1 SUMMARY

- A. Section Includes:
 - 1. GMF gypsum backing board.
 - 2. Installation materials.
 - 3. Joint treatment materials.
 - 4. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Section Includes:
 - 1. Section 09 29 00 for requirements for marking and identification of wall and partition construction required to have protected openings or penetrations.
GMF gypsum backing board.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. GMF: Glass Mat Faced.
- B. Definitions:
 - 1. Manufacturer: Means the backing board manufacturer, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished plaster.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Backing boards must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Backing board must be manufactured in North America by a domestic company from gypsum mined in North America; synthetic gypsum recovered from coal-fired plants operating in North America (FGD gypsum); or a combination of both.
 - a. Backing board manufactured outside of North America by a domestic company are prohibited.
 - b. Backing board manufactured outside of North America by a foreign company and relabeled or rebranded by a domestic company are prohibited.
3. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

1.5 HANDLING

- A. General: Comply with GA publication GA 801 “*Handling Gypsum Board*” and applicable requirements of ASTM C 1264 for the inspection, rejection, certification, packaging, marking, shipping, handling, and storage of gypsum panel products.
- B. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Unload and store only inspected and accepted items.
- C. Storage: Store unloaded items as shipped and in conformance with manufacturer’s instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
 1. Store items indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas; where “wet work” within storage areas (e.g., concrete, cast underlayment, mortaring, grouting, plastering, gypsum board finishing, etc.) is complete and cured or dried to a condition of equilibrium.
 2. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage.
- D. Handling: Handle items in conformance with manufacturer’s instructions and other requirements and recommendations, and in a manner that that prevents damage.

- E. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- F. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Provide products manufactured by one of the following, or equal.
 - 1. CertainTeed Corp.
 - 2. GP Building Products.
 - 3. National Gypsum Co.
 - 4. USG Corp.

2.2 GMF GYPSUM BACKING BOARD

- A. Description: Gypsum-based GMF water-resistant gypsum backing panel conforming to ASTM C 1178 installed as a base for the application of ceramic tile.
- B. Applications: Installed as a base for the application of ceramic tile and behind fiberglass bathtub surround walls.
- C. Restrictions: May not be used
 - 1. as a base for nailing or mechanical fastening;
 - 2. as a radiant barrier behind fireplaces;
 - 3. in exterior applications; and
 - 4. In direct contact with concrete or concrete masonry units.
- D. Products: Provide one of the following, or equal.
 - 1. "DensShield Tile Backer" manufactured by GP Building Products.
 - 2. "GlasRoc Tile Backer" manufactured by CertainTeed Corp.
 - 3. "Gold Bond eXP Tile Backer" manufactured by National Gypsum Co.
- E. Requisite Properties:
 - 1. Minimum Size: At least 4-foot by 8-foot sheets.
 - 2. Minimum Thickness: 1/2-inch regular core panels and 5/8-inch Type X panels.
 - 3. Minimum Mass: At least 2.2 pounds per square foot.
 - 4. Edges: Tapered long edges and square ends.
 - 5. Facers: Heat-cured, acrylic-coated, fiberglass mat wrapped around panel face, back side, and long edges. Water repellent paper facers and backings are prohibited.
- F. Performance Requirements:
 - 1. Resistance to the Propagation of Mold and Mildew: Minimum score of 10 (no visual defacement), when tested in conformance with ASTM D 3273.

2.3 INSTALLATION MATERIALS

- A. Fasteners: Provide 0.164-inch shank diameter (#8-32 UNC) by at least 1-1/4-inch-long Philips drive socket, bugle or wafer head, self-drilling stainless steel, bi-metal, duplex anti-corrosive steel, 3-coat anti-corrosive steel, or ceramic-coated anti-corrosive steel screw fasteners, unless another fastener type is explicitly indicated; or is otherwise supplied, required, recommended, or accepted by the manufacturer.

2.4 JOINT TREATMENT MATERIALS

- A. Glass Mesh Tape:
 - 1. Description: 2-inch wide, alkali-resistant, polymer-coated, 10x10 glass-fiber mesh tape.
 - 2. Application: Used in combination with joint sealant as a panel joint and penetration treatment for long-term joint protection.
 - 3. Product: Supplied, required, recommended, or accepted by the manufacturer.
- B. Polymer-Modified Cementitious Mortar:
 - 1. Description: Premium-grade (best quality grade), single-component, ultra-high-performance, polymer-modified Portland cement mortar conforming to A118.15 shear bond strength requirements.
 - 2. Application: Used for embedding joint tape and finishing backing board in wet locations (e.g., toilet rooms, shower rooms, saunas, steam rooms, kitchens, swimming pool enclosures, etc.). Do not use drying-type joint compound, setting-type joint compound, or paper tape in wet locations.
 - 3. Products: Provide one of the following, or equal.
 - a. “MegaFlex Crack Prevention Mortar” manufactured by Custom Building Products.
 - b. “254 Platinum” manufactured by LATICRETE International, Inc.
 - c. “Ultraflex 3” manufactured by Mapei Corp.
- C. Setting-Type Joint Compound:
 - 1. Description: Lightweight, sandable, chemically setting powder compound conforming to ASTM C 475 and
 - 2. Application: Used for embedding joint tape and finishing backing board in locations other than wet locations. All-purpose and drying type joint compounds are prohibited.
 - 3. Product: “ToughRock Sandable Setting Compound” manufactured by GP Building Products, or equal.
- D. Manufacturer: Provide products manufactured by one of the following, or equal.Corp.

2.5 ACCESSORIES

- A. Sealant: Provide fluid-applied low modulus joint sealant specified in Section 07 92 00, unless another type of sealant; or supplied, required, recommended, or accepted by the manufacturer to seal sheathing joints and fastener penetrations.
- B. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install backing boards using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed backing boards must be warrantable. Do not install, correct, or replace backing boards in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items:
 - 1. Provide materials, components, and accessories normally furnished or necessary to securely attach backing boards to supporting construction.
 - 2. Do not install vapor retarders directly behind backing board.
- C. Installation Tolerances: Install backing boards to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;

2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

END OF SECTION 09 28 15

SECTION 09 29 00 – GYPSUM BOARD

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum board panels.
 - 2. Metal trim.
 - 3. Installation materials.
 - 4. Joint treatment materials.
 - 5. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 09 28 15 for GMF gypsum tile backing board.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. GMF: Glass Mat Faced.
- B. Definitions:
 - 1. Manufacturer: Means the backing board manufacturer, unless otherwise indicated.
 - 2. Enclosure: Means a level of protective resistance to weather provided for interior spaces during the construction phase by either permanent construction or substantial temporary construction. Other terms, including “enclosed” and similar terms, have the same meaning as “enclosure”.
 - a. Uncontrolled Enclosure: Means short-term, limited, temporary protection against wind for up to 6 months before completion of the permanent enclosure, as determined by the Architect, whose decision is final.
 - b. Partially-Controlled Enclosure: Means medium-term, limited, temporary protection against both wind and rain for up to 12 months before completion of the permanent enclosure, as determined by the Architect, whose decision is final.
 - c. Permanent Enclosure: Means complete permanent protection against wind, temperature, humidity, atmospheric pressure, and precipitation; provided by a permanent insulated and weathertight roofing system, permanent insulated and weathertight exterior wall construction, and openings closed with permanent protectives or substantial temporary closures equivalent in protection to permanent protectives, as determined by the Architect, whose decision is final.
 - 3. Dry-In: Means that the building shell is sufficiently complete to keep out wind, rain, and other weather. Other terms, including “box-in” and similar terms, have the same meaning as “dry-in”. At a minimum, dry-in includes
 - a. all exterior walls are constructed with weather-resistive barrier or air barrier applied;
 - b. roof deck is installed with an appropriate waterproof covering; and
 - c. windows and doors are installed.
 - 4. Locations:

- a. Wet Locations: Means interior locations subject to moisture during normal activities for which the space was designed (e.g., toilet rooms, shower rooms, saunas, steam rooms, kitchens, swimming pool enclosures, etc.)
 - b. Dry Locations: Means normally dry interiors.
- 5. Pre-Rock Construction: Means the limited installation of gypsum board panels in locations exposed to ambient moisture during the normal construction cycle before the structure is either partially controlled or permanently enclosed. Pre-rock construction is not limited to top-down construction. Other terms, including “pre- dry-in” and similar terms, have the same meaning as “pre-rock”.
- 6. Top-Down Construction: Means the limited installation of gypsum board panels only in plenums above the finished ceiling plane after the installation of metal framing is complete and before the installation of ducts, conduits, pipes, or other items that penetrate the gypsum board assemblies begins.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate locations of control joints to ensure the recommended spacings of control joints for gypsum wall and ceiling panels are accommodated.
 - a. If control joints are not indicated on the construction drawings, do not anticipate the quantity is zero.
 - b. Propose locations on shop drawings or submit an RFI to the Architect before submitting bid proposal.
 - 2. Final locations of control joints are subject to Architect’s approval.
- B. Preinstallation Meeting:
 - 1. Hold the meeting after submittal approval and at least 10 business days before beginning installation.
 - 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation.
 - 3. Discuss and finalize locations and extents of all control joints.
 - 4. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed underlayment. Resolve each condition.
 - 5. Finalize construction schedule.
 - 6. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.
- C. Sequencing: Deliver paper-faced gypsum board to the project site only after building dry-in.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets

- (SDSs), both of which are returned to the Contractor without review or responsive action.
2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing locations, sizes, and extents of all control joints. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished plaster.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Gypsum board must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Gypsum board must be manufactured in North America by a domestic company from gypsum mined in North America; synthetic gypsum recovered from coal-fired plants operating in North America (FGD gypsum); or a combination of both.
 - a. Gypsum board manufactured outside of North America by a domestic company are prohibited.
 - b. Gypsum board manufactured outside of North America by a foreign company and relabeled or rebranded by a domestic company are prohibited.
 3. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Qualifications:
1. Installer: Company or individuals must have at least 5 years' experience installing gypsum board for at least 30 previous projects similar to this project in size, material, design, and complexity.
 2. Supervisors: Individuals must have at least 7 years' experience installing gypsum board for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading gypsum board installers.

1.6 HANDLING

- A. General: Comply with GA publication GA 801 “*Handling Gypsum Board*” and applicable requirements of ASTM C 1264 for the inspection, rejection, certification, packaging, marking, shipping, handling, and storage of gypsum panel products.
- B. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- C. Storage: Store unloaded items as shipped and in conformance with manufacturer’s instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
 - 1. Furnish adequate dunnage and bracing during storage.
 - 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.
 - 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- D. Handling: Handle items in conformance with manufacturer’s instructions and other requirements and recommendations, and in a manner that that prevents damage.
- E. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- F. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Provide products manufactured by one of the following, or equal.
 - 1. CertainTeed Corp.
 - 2. GP Building Products.
 - 3. National Gypsum Co.
 - 4. USG Corp.

2.2 PRE-ROCK GYPSUM BOARD

- A. Description: Gypsum-based GMF water-resistant gypsum backing panel conforming to ASTM C 1178 installed as a base for the application of ceramic tile.
- B. Application: Pre-rock panels must be used when gypsum board is installed prior to dry- in.

- C. Products: Provide one of the following, or equal.
 - 1. “DensArmor Plus Interior Panels” manufactured by GP Building Products.
 - 2. “e2XP Interior Extreme” manufactured by National Gypsum Co.
 - 3. “SHEETROCK Glass-Mat Panels Mold Tough” manufactured by USG Corp.
- D. Requisite Properties:
 - 1. Minimum Size: Provide at least 4-foot by 8-foot sheets.
 - 2. Minimum Thickness: 1/2-inch regular core panels and 5/8-inch Type X panels.
 - 3. Edges: Tapered long edges and square ends.
 - 4. Facers: Heat-cured, acrylic-coated, fiberglass mat on the face side, back side, and around long edges. Water repellent paper facers and backings are prohibited.

2.3 FIRE-RESISTANCE RATED GYPSUM BOARD

- A. Fire-Resistance-Rated Gypsum Wall and Ceiling Board:
 - 1. Description: Gypsum board conforming to ASTM C 1396.
 - 2. Applications: Installed in fire-resistance-rated and non-rated interior partition assemblies constructed in dry locations.
 - 3. Products: Provide one of the following, or equal.
 - a. “ProRoc Type X” and “ProRoc Type C” manufactured by CertainTeed Corp.
 - b. “ToughRock Fireguard” and “ToughRock Fireguard C” manufactured by GP Building Products.
 - c. “Gold Bond Fire-Shield” and “Gold Bond Fire-Shield C” manufactured by National Gypsum Co.
 - d. “SHEETROCK “Firecode Core”” and “SHEETROCK “Firecode C Core”” manufactured by USG Corp.
 - 4. Requisite Properties:
 - a. Minimum Size: At least 4-foot by 8-foot sheets.
 - b. Minimum Thickness: At least 5/8-inch.
 - c. Core: Provide Type X panels in walls and Type C panels in ceilings, unless otherwise indicated on the Drawings.
 - d. Minimum Mass: At least 2.2 pounds per square foot.
 - e. Edges: Tapered long edges and square ends.
 - f. Facers: Paper face, back, and long edges.
- B. Mold- and Moisture-Resistant Fire-Resistance-Rated Gypsum Wall and Ceiling Board:
 - 1. Description: Mold- and moisture-resistant and fire-resistance-rated gypsum board conforming to ASTM C 1396.
 - 2. Applications: Installed as the inside face of exterior wall assemblies; and in fire-resistance-rated and non-rated interior partition assemblies constructed in wet locations.
 - 3. Products: Provide one of the following, or equal.
 - a. “ProRoc Moisture and Mold Resistant Gypsum board with M2Tech” manufactured by CertainTeed Corp.
 - b. “ToughRock Mold-Guard” manufactured by GP Building Products.
 - c. “Gold Bond XP Gypsum Board” manufactured by National Gypsum Co.
 - d. “SHEETROCK Mold Tough” manufactured by USG Corp.
 - 4. Requisite Properties:
 - a. Minimum Size: At least 4-foot by 8-foot sheets.
 - b. Minimum Thickness: At least 5/8-inch.

- c. Core: Provide Type X panels in walls and Type C panels in ceilings, unless otherwise indicated on the Drawings.
- d. Minimum Mass: At least 2.2 pounds per square foot.
- e. Edges: Tapered long edges and square ends.
- f. Facers: Heavy-duty mold- and moisture-resistant paper face, back, and long edges.
- 5. Performance Requirements:
 - a. Mold Resistance: Must earn a score of at least 10, when tested in conformance with ASTM D 3273.

2.4 METAL TRIM

- A. Steel Trim:
 - 1. Description: Paper-faced galvanized steel sheet trim pieces conforming to ASTM C 1047.
 - 2. Manufacturers: Provide products manufactured by one of the following, or equal.
 - a. CEMCO.
 - b. Clinch-On Cornerbead Co.
 - c. Stockton Products.
 - d. Western Metal Lath.
 - e. USG Corp
 - 3. Products: “BEADEX” paper-faced metal bead and trim manufactured by USG Corp., or equal.
 - a. Corner Beads: Provide to protect exterior corners. Provide corner beads with notched or flexible flanges at curved edges.
 - 1) 90-degree Outside Corner Bead: “Micro Bead Style”, or equal.
 - 2) 90-degree Inside Corner Bead: “B2 Style”, or equal.
 - b. Casing Beads: Provide long-flanged L- or LC-beads at exposed panel edges indicated as receiving joint compound; provide short-flanged U-beads at exposed panel edges that do not receive joint compound.
 - 1) J Trims (J-shaped with exposed long flange): “B9J Style”, or equal.
 - 2) L Trims (L-shaped with exposed long flange): “B4 Style”, or equal.
- B. Metal Control Joints:
 - 1. Description: One-piece solid zinc control joint supplied with factory-applied removable tape to ensure a clean joint.
 - 2. Products: Provide one of the following, or equal.
 - a. “NO93 Control Joint” manufactured by Alabama Metal Industries Corp. Building Products (AMICO).
 - b. “Niles-093 Zinc Control Joint” manufactured by Niles Building Products Co.
 - c. “SHEETROCK Zinc Control Joint No. 093” manufactured by USG Corp.
 - 3. Requisite Properties:
 - a. Minimum Length: At least 10 feet long; provide longest possible lengths to minimize or avoid joints

2.5 INSTALLATION MATERIALS

- A. Fasteners: Provide #6-32 UNC 2B (0.138-inch shank diameter, 32 threads per inch) by at least 1-1/4-inch long, Philips bugle head, coarse thread, self- piercing or self-drilling (as applicable) phosphate coated steel screw fasteners, unless another fastener type is explicitly indicated; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

- B. Laminating Adhesive:
1. Description: Lightweight, sandable, chemically-setting powder compound conforming to ASTM C 475.
 2. Application: Used for bonding gypsum board to studs, laminating gypsum board to gypsum board, and bonding gypsum board to concrete or CMU walls.
 3. Product: "SHEETROCK Easy Sand Joint Compound" manufactured by USG Corp., or equal.

2.6 JOINT TREATMENT MATERIALS

- A. Joint Tape:
1. Description: Nominal 2-inch wide gypsum panel joint and corner reinforcement conforming to ASTM C 475.
 2. Products:
 - a. Fiberglass Joint Tape: "SHEETROCK Fiberglass Drywall Tape" manufactured by USG Corp., or equal.
 - b. Paper Joint Tape: "BEADDEX Drywall Joint Tape" manufactured by USG Corp., or equal.
 - c. Fiberglass Mesh Tape: Prohibited.
- B. Setting-Type Joint Compound:
1. Description: Lightweight, sandable, chemically setting powder compound conforming to ASTM C 475, and used for embedding joint tape and finishing interior gypsum panels.
 2. Applications:
 - a. Pre-Filling Gypsum Panel Joints throughout the Project: Use setting-type compound for open joints, beveled panel edges, and at damaged surface areas at all locations.
 - b. All Other Coats: Use setting-type compound for embedding and first coat, fill coat, finish coat, and skim coat at wet locations; and at locations where panels are subject to moisture and high humidity.
 3. Product: "SHEETROCK DURABOND" manufactured by USG Corp., or equal.
- C. Drying-Type Joint Compound:
1. Description: Vinyl-type compound conforming to ASTM C 475, and used for embedding joint tape, finishing interior gypsum panels, and hand-applying simple texturing.
 2. Application: Use for embedding and first coat, fill coat, finish coat, and skim coat at dry locations, and at locations where joint is subject to moisture and high humidity.
 3. Product: "SHEETROCK All Purpose Joint Compound – SELECT" and "SHEETROCK Brand Plus 3 Lightweight All-Purpose Joint Compound" manufactured by USG Corp., or equal.

2.7 ACCESSORIES

- A. Texture Finish:
1. Description: Unaggregated texture coating wall and ceiling texture.
 2. Restrictions: New concrete and new plaster must age at least 60 days before texturing.
 3. Concrete Crack Repair and Surface Preparation: Setting-type compound specified above.
 4. Primer: "SHEETROCK FIRST COAT Primer" manufactured by USG Corp., or equal.
 5. Texture Product: "SHEETROCK TUF-TEX" manufactured by USG Corp., or equal.

- 6. Finish: Fine orange peel.
- B. Applied Level 5 Wallboard Finish Products: Prohibited.
- C. Repair Clips: “SHEETROCK Drywall Repair Clips” manufactured by USG Corp., or equal.
- D. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.8 MARKING AND IDENTIFICATION

- A. Description: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions, and other walls required by the International Building Code to have protected openings or penetrations must be effectively and permanently identified with stenciling located in accessible concealed floors, floor-ceiling assemblies, plenums, and attic spaces
- B. Paint Products: Specified in Section 09 91 00.
- C. Fire Walls, Fire Barriers, and Fire Partitions: Paint 6-inch high stripes not more than 15 feet from the end of each fire wall, fire barrier, or fire partition; and at intervals of not more than 30 feet, when measured horizontally along the wall, barrier, or partition. Paint stenciled letters over the 6-inch high stripes, leaving at least a one-inch border around the stenciled letter copy.
 - 1. Stripe Color: Match Federal Standard 595B color FS 31350 (red).
 - 2. Stenciled Letter Color: Match Federal Standard 595B color FS 37925 (insignia white).
 - 3. Stenciled Letter Font: 288-Point Linotype Neue Helvetica Regular Bold.
 - 4. Stenciled Letter Copy:
 - a. Fire Walls: “FIRE WALL – PROTECT ALL OPENINGS”.
 - b. Fire Barriers: “FIRE BARRIER – PROTECT ALL OPENINGS”.
 - c. Fire Partitions: “FIRE PARTITIONS – PROTECT ALL OPENINGS”.
- D. Smoke Barriers and Smoke Partitions: Paint 6-inch high stripes not more than 15 feet from the end of each smoke barrier or smoke partition; and at intervals of not more than 30 feet, when measured horizontally along the wall, barrier, or partition. Paint stenciled letters over the 6-inch high stripes, leaving at least a one-inch border around the stenciled letter copy.
 - 1. Stripe Color: Match Federal Standard 595B color FS 36492 (gray).
 - 2. Stenciled Letter Color: Match Federal Standard 595B color FS 37038 (black).
 - 3. Stenciled Letter Font: 288-Point Linotype Neue Helvetica Regular Bold.
 - 4. Stenciled Letter Copy:
 - a. Smoke Barriers: “SMOKE BARRIER – PROTECT ALL OPENINGS”.
 - b. Smoke Partitions: “SMOKE PARTITIONS – PROTECT ALL OPENINGS”.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.

- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install gypsum board using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed gypsum board must be warrantable. Do not install, correct, or replace gypsum board in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Single-Layer Application:
 - a. On ceilings, apply gypsum panels before wall or partition board application to greatest extent possible, and at right angles to framing, unless otherwise indicated.
 - b. On partitions and walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assemblies; minimize end joints.
 - c. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assemblies.
 - d. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - e. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - f. Securely attach gypsum panels to supports with steel drill screws.
 - 2. Multilayer Application:
 - a. On partitions and wall assemblies, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - b. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - c. Securely attach base layers and face layers separately to supports with screws. Do not glue multiple layers of gypsum board together.
 - 3. Trim:

- a. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in conformance with manufacturer's instructions.
 - b. Control Joints: Install control joints in conformance with ASTM C 840 and in specific locations indicated or accepted by the Architect.
 - c. Trim: Install cornerbead at outside corners; install LC-Bead or U-Bead at exposed panel edges.
 - 4. Finishing Gypsum Board:
 - a. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and other items and conditions as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 - b. Prefill open joints, beveled edges, and damaged surface areas.
 - c. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- C. Acoustical Installation Requirements:
- 1. Comply with ASTM C 840.
 - 2. Install panels with face side out. Butt panels together with light contact at edges and ends and not more than 1/16-inch of open space between panels. Do not force into place.
 - 3. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided.
 - 4. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - 5. All joints must be staggered at least 24 inches apart and taped and sealed. Where multi-layer construction is indicated, each layer must be complete, including tape, fillers, and seals, before further layers are added.
 - 6. Joints between uncut sheet that lie in the same plane must be tight butt joints. The gap between sheets may not exceed 1/8-inch.
 - 7. Tolerances: Install partitions with the following maximum gaps between gypsum board and abutting construction.
 - a. Floor: 1/4-inch.
 - b. Masonry and Concrete Walls: 1/4-inch.
 - c. Underside of Slab or Decking: 1/4-inch.
 - 8. Damaged sheets may not be used. Joints between cut sheets that lie in the same plane or between any sheets that lie in different planes (i.e., at any angle or corner joint) must be cut back to produce a neat gap not more than 1/16-inch wide and the joint filled and sealed with specified non-hardening acoustic sealant. Subsequent layers must cover the joint and the opposite sheet must be cut short and filled and sealed.
 - 9. In the first layer, all joints between boards must be backed by a continuous stud, noggin, bearer, or angle.
 - 10. Specified batt insulation must be placed in the wall cavity and be suitably retained so that it is in contact with only one face of the partition and does not sag.
 - 11. Wall ties between adjacent independent partitions must be of a resilient type and accepted by the Architect. The minimum number compatible with safe construction should be used.
 - 12. The walls must be constructed from slab to slab (full height) unless otherwise indicated.
 - 13. Where door frames are built into the wall, the vertical and horizontal sections of the frame shall be fully filled with plaster. The plaster joint shall be to the full depth of the wall.

14. Top and bottom of stud walls must be Isolated with resilient partition isolation pad (e.g., “Wallmat and Anchor Isolator” manufactured by Kinetics Noise Control, Inc., or equal)
15. Lateral support at the head of vibration isolated gypsum walls must be a continuous steel angle with a resilient pad to avoid rigid contact between the wall and the lateral support construction and accepted by the Architect. (e.g., wall mount type AB by Mason Industries, or equal)
16. All joints between gypsum and other constructions must be dense packed with fiberglass to the full depth of the wall and fully sealed with a sealant bonding to the gypsum and the other construction.
17. Where gypsum walls abut a profiled metal decking, the gypsum wall should seal to a minimum 16 -gage steel plate attached to the deck, with the profile void above the plate filled with fiberglass and acoustically sealed on both sides with a fire barrier putty having a minimum density of 40 pounds per square foot. (e.g., 3M Moldable Putty or equal)
18. For top of walls that are perpendicular with the metal decking maximum of ½ inch gap from the flute and seal the openings with acoustical sealant.
19. Penetrations of building services (e.g., ducts, conduits, pipes) through full height and acoustic rated partitions must be sealed airtight in conformance with the following.
 - a. Seal all annular openings less than 1/2-inch with acoustical sealant and backer rod as required to hold sealant in place.
 - b. When the annular opening is larger than 1/2-inch, provide gypsum board patch to reduce the opening to less than 1/2-inch, and seal as above.
 - c. Prior to sealing penetrations, verify penetrating elements such as piping and ductwork are free and clear of the opening being sealed.
20. Cut-outs must be regular and may not fracture gypsum board core or tear covering and must conform to the following.
 - a. Minimize penetrations of insulated wall and ceiling construction. Penetrate only where necessary and fully seal airtight at the perimeter using acoustical sealant.
 - b. Where ducts and piping greater than 3-inches in diameter penetrate insulated wall or ceiling construction, provide a clearance of one-inch plus 1/4-inch at the perimeter of the penetration
 - c. Where conduit piping 3-inches diameter and less (including mechanical, hydraulic, plumbing, etc.) pass through insulated wall or ceiling construction, provide a clearance of 1/4-inch plus 1/8-inch between the conduit or piping and the structure, unless otherwise shown.
 - d. After the ductwork, conduit, or piping is installed, repair the gypsum board perimeter clearance to the specified tolerance as required. Where the clearance exceeds 3/4-inch, provide a sheet metal sleeve within the partition packed with safing insulation and seal both sides airtight with acoustical sealant.
 - e. Where penetration clearances are 3/8-inch or less, seal airtight with acoustical sealant at gypsum board. Where the perimeter clearance exceeds 3/8-inch, use a flexible backing rod to seal against.
 - f. All gypsum board penetrations (including those resulting from wiring, cables, and electrical junction boxes) must be sealed airtight with acoustical sealant.
 - g. The back and sides of junction boxes in sound-rated construction must be sealed airtight with sheet caulking. Seal perimeter face at gypsum board with acoustical sealant.
 - h. Recessed panel boards, equipment, boxes, and other items having a penetration area greater than 25 square inches at sound-rated partitions are fully enclosed and sealed with 5/8-inch thick gypsum board or 2 pound per square foot sheet metal.
 - i. Seal multiple conduit penetrations airtight with expanding fire foam sealant.

- D. Interface with Adjacent Items:
 - 1. Provide materials, components, and accessories normally furnished or necessary to securely attach backing boards to supporting construction.
 - 2. Do not install vapor retarders directly behind gypsum board.
- E. Installation Tolerances: Install backing boards to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed gypsum board in place from deterioration, and damage until Substantial Completion. Remove and replace wet, moisture-, or mold-damaged panels.
 - 1. Indications panels are wet or moisture damaged include discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include fuzzy or splotchy surface contamination and discoloration.
- B. Do not store anything adjacent to or against installed gypsum board unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed gypsum board as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

3.6 GYPSUM BOARD FINISH SCHEDULE

- A. General: Finish gypsum board surfaces with exposed joints, corners and edges reinforced or trimmed in conformance with ASTM C 840, Gypsum Association publication GA-214, *“Recommended Levels of Gypsum Board Finish”*, and the following.
- B. Levels of Gypsum Board Finish:
 - 1. Level 0: Use for first layer of multiple layer construction and gypsum board ledge guards in elevator shafts.
 - 2. Level 1: Use in plenum areas above ceilings, interior faces of shafts, in attics, and in areas where the assembly will generally be concealed.
 - 3. Level 2: Use where moisture-resistant gypsum backing board is used as a substrate for tile; and in storage and similar areas where surface appearance is not of primary concern.
 - 4. Level 3: Use in areas where heavy grade wall coverings are to be applied as the final decoration.
 - 5. Level 4: Use in areas where light texture or backed lightweight wall covering is applied; and all areas indicated as receiving a paint finish, except where Level 5 finish is indicated.
 - 6. Level 5 (spray and roller-applied products are prohibited): Use where indicated on the Drawings.

END OF SECTION 09 29 00

SECTION 09 30 00 – TILING

1.1 SUMMARY

- A. Section Includes:
 - 1. Tile surfacing units.
 - 2. Thresholds.
 - 3. Tile waterproofing.
 - 4. Installation materials.
 - 5. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 03 35 10 for concrete flatwork finishing and curing; and for preventative MVER products.
 - 2. Section 09 05 16 for preparation of concrete slabs for finish flooring; and for remedial MVER products.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. TCNA: Tile Council of North America.
- B. Definitions:
 - 1. Manufacturer: Means the tile, installation material, or accessory manufacturer, as the context admits, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify chemical and adhesive compatibility of selected waterproofing and crack isolation membranes and mortar with installed curing compounds and moisture vapor emission control systems, based on current product formulations.
 - 2. Proposed substitution requests and submittals that change the quality (grade) or generic chemistry of specified mortar and grout are prohibited and returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
- B. Preinstallation Meeting:
 - 1. Hold a meeting after submittal approval and at least 10 business days before beginning installation.
 - 2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation.
 - 3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed tile. Resolve each condition.
 - 4. Finalize construction schedule.

5. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.
- C. Sequencing: Deliver paper-faced gypsum board to the project site only after building dry-in.
1. Schedule tile deliveries to the project site only after the building is enclosed with a permanent enclosure; “wet work” within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; storage areas are broom- and vacuum-clean; and the HVAC system is activated, operating, and maintaining ambient conditions at occupancy levels.
 2. Install tile only after substrate is cured to a condition of equilibrium; is sufficiently dry to bond with tile; and has alkalinity (pH), MVER, and RH within ranges required, recommended, or accepted by the manufacturer. Provide chemically and adhesively compatible surface treatment when required or necessary to reduce pH and MVER to within allowable limits required, recommended, or accepted by the manufacturer.
 3. Final light fixtures must be completely installed and energized before beginning installation.
 4. Install tile only after penetrating items are installed and after overhead finishing operations are complete.
- D. Scheduling:
1. Concrete Curing: Allow enough time in the construction schedule for concrete to cure for at least 28 days before beginning surface preparation and installation.
 2. Access Restrictions: Close spaces during installation. Keep closed to foot traffic after installation for at least 48 hours and to rolling load traffic for at least 72 hours.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
1. Product Data: Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing floor and wall design patterns and layouts.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans and elevations.
 3. Samples: Submit at least 8-inch square representative samples of each tile variety for each specified color and finish, glued to hardboard backing. Grout all joints with specified grout.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer’s Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished plaster.

- a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Maintenance Material Submittals: Before Final Completion, deliver to the Owner tile cleaning materials, equipment, accessories, and instructions; and extra stock materials to replace those worn or damaged as a result of normal occupancy.
- 1. Furnish at least 2 percent of the total installed for each tile type, color, composition, grade, finish, and variety.
 - 2. Furnish at least 2 percent of the total amount installed for each grout type, color, and composition. but not less than one unopened container.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
- 1. Tile must be obtained through one source from the same supplier (to ensure compatibility and appearance).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Installation Materials (Setting Materials): Installation materials, including waterproofing membranes, crack isolation membranes, mortar, adhesive, grout, sealers, and other installation materials and accessories must be obtained through one source from the same manufacturer (to ensure compatibility and a warrantable installation).
 - 3. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Tile Floor Finish Regulatory Requirements:
- 1. Floor surfaces must be stable, firm, and slip resistant, conforming to the requirements of International Building Code.
 - 2. Allowable Static Coefficient of Friction Value (SCOF): At least 0.6 for level surfaces and at least 0.8 for sloped surfaces, when measured in conformance with ASTM D 2047.
 - 3. Allowable Dynamic Coefficient of Friction Value (DCOF): Between 0.35 and 0.45, when measured in conformance with ANSI B101.3 under wet conditions.
 - 4. Radiant Flux Classification: Provide flooring having an average critical radiant flux value of at least 0.45 (Class I), when tested in conformance with ASTM E 648.
- C. Tile Wall Finish Regulatory Requirements:
- 1. Surface-Burning Characteristics: Provide walls and ceilings having a maximum FSI Value of 25 or less and a maximum SDI Value of less than 450 (Class A), when tested in conformance with ASTM E 84.
- D. Quality Standards:

1. Installation Standards: Comply with parts of ANSI A108 Series publication requirements that apply to types of setting and grouting materials and to installation methods indicated.
 2. Installation Guidelines: Comply with TCNA publication “*Handbook for Ceramic, Glass, and Stone Installation*” requirements for installation methods indicated.
- E. Qualifications:
1. Installer: Company or individuals must have at least 5 years’ experience installing tile for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - a. Individuals must be Ceramic Tile Education Foundation (CTEF) Certified Tile Installers and current in their certification.
 - b. Individuals installing large format tile, mudwork for walls or floors, or waterproofing membranes must be certified through Advanced Certifications for Tile Installers (ACT) for installation and current in their certification.
 2. Supervisors: Individuals must have at least 7 years’ experience installing tile for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years’ supervisory experience directing and leading tile installers.
 - a. Supervisors must be Ceramic Tile Education Foundation (CTEF) Certified Tile Installers and current in their certification.
 - b. Supervisors of individuals installing large format tile, mudwork for walls or floors, or waterproofing membranes must be certified through Advanced Certifications for Tile Installers (ACT) for installation and current in their certification.
- F. Field Samples: Include in-situ mockups as part of the work of this specification section.
1. The Architect reviews field samples for conformance to the Contract Documents and approves or rejects them as the standard by which subsequent work is evaluated.
 2. Revise field samples and repeat reviews, including arranging all revisions and paying all revision costs, until accepted in writing by the Architect. Final acceptance of tile is made from field samples.
 3. After acceptance, promptly identify and protect field samples for reference until Substantial Completion.
 4. Approved field samples may remain part of the work after being identified for future reference.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped and in conformance with manufacturer’s instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.

3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install tile only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Existing Conditions:
 1. Substrate Dimensional Tolerances: Surfaces receiving tile must be flat with 1/4-inch within any 10-foot radius.
 2. Deflection: Maximum deflection of substrate system under positive or negative design loads must not exceed $L/360$ of span.
 3. Illumination: Provide permanent lighting or illuminate work spaces to at least the same type, illumination level, and color temperature maintained in the room or space after the building is occupied.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for waterproofing products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 10 years.
- B. Installer Guarantee: Furnish to the Owner a written guarantee for waterproofing work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 TILE SURFACING UNITS

- A. Products: Design Selections indicated on the Drawings or selected by the Architect, or equal.

2.2 THRESHOLDS

- A. Marble Thresholds:

1. Description: Marble conforming to ASTM C 503, Classification I (calcite), Soundness Group A (sound marbles with uniform and favorable working qualities; containing no geological flaws, voids, spalls, cracks, open seams, pits or other defects).
2. Product: Bianco Carrara (Carrera) marble thresholds.
3. Requisite Properties:
 - a. Size and Thickness: Indicated on the Drawings.
 - b. Color: White, with wispy grey bands through the stone.
 - c. Finish: Honed.

2.3 INSTALLATION MATERIALS

- A. Manufactured Tub and Shower System:
 1. Description: Shower pans, wallboards, and accessories manufactured from closed-cell XPS foam insulation with a polymer-modified cement coating.
 2. Product: "HYDRO-BLOCK" shower system manufactured by HYDROBLOK International Ltd., or equal.
- B. Trowelable Patch and Fill Materials: Specified in Section 03 54 16, unless other products are supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- C. Moisture Vapor Transmission Reduction Coating: Specified in Section 03 35 10 (preventative) or Section 09 05 16 (remedial), unless another coating is supplied, required, recommended, accepted by the by manufacturer for actual in-service conditions applicable to the project.
- D. Fluid-Applied Waterproofing / Crack Isolation Membrane:
 1. Products: Provide one of the following, or equal.
 - a. "RedGard" elastomeric membrane manufactured by Custom Building Products.
 - b. "Laticrete HydroBan" manufactured by LATICRETE International, Inc.
 - c. "Mapelastac AquaDefense" manufactured by Mapei Corp.
 2. Accessories:
 - a. Primer: One-part waterproofing / crack isolation membrane diluted with 4 parts water and applied at a rate of 300 square feet per gallon of reduced material; or other substrate sealer or primer supplied, required, recommended, approved or accepted manufactured by the waterproofing/crack isolation membrane manufacturer.
 - b. Fiberglass Mesh: Provide manufacturer's standard alkali-resistant reinforcing mesh for changes of plane and for gaps 1/8-inch wide or greater.
 - c. Other Accessories: Provide other accessories and secondary items supplied, required, recommended, approved, or accepted manufactured by the waterproofing/crack isolation membrane manufacturer.
- E. Thin Bed Mortar (Thinset) Installations (horizontal applications between 3/32- and 3/16-inch thick after beat-in):
 1. Description: Premium-grade (best quality grade), single-component, ultra-high-performance, polymer-modified Portland cement mortar conforming to A118.15 shear bond strength requirements.

2. Application: Used for the installation of interior and exterior floor and wall vitreous, semi-vitreous or non-vitreous tile (ceramic, mosaic, quarry, and cement body tile); impervious porcelain tile; and natural stone veneer and stone tile.
 3. Products: Provide one of the following, or equal.
 - a. “FlexBond Crack Prevention Thin-Set Mortar” manufactured by Custom Building Products.
 - b. “254 Platinum” manufactured by LATICRETE International, Inc.
 - c. “Ultraflex 3” manufactured by Mapei Corp.
- F. Medium Bed Mortar Installations (horizontal applications between 3/8- and 3/4-inch thick after beat-in):
1. Description: Regular-setting, polymer-modified mortar conforming to A118.15 shear bond strength requirements.
 2. Application: Used for the installation of the installation of
 - a. large-format dimensional tile (greater than 12 by 12 inches);
 - b. inconsistent thickness natural stone; and
 - c. tiles and pavers having slight substrate irregularity
 3. Products: Provide one of the following, or equal.
 - a. “Natural Stone & Large Tile Medium Mortar” manufactured by Custom Building Products.
 - b. “LATICRETE 4-XLT” manufactured by LATICRETE International, Inc.
 - c. “Ultraflex LFT” manufactured by Mapei Corp.
- G. Polymer-Modified Cementitious Sanded Grout:
1. Description: Premium-grade, pre-mixed, Portland cement sanded grout conforming to ANSI A118.7, and having a specifically-tailored, integrally-mixed antimicrobial agent.
 2. Application: Used for typical joints between 1/8- and 1/2-inch wide.
 3. Products: Provide one of the following, or equal.
 - a. “Prism Ultimate Performance Grout” manufactured by Custom Building Products.
 - b. “LATICRETE PermaColor” manufactured by LATICRETE International, Inc.
 - c. “Ultracolor Plus FA” manufactured by Mapei Corp.
 4. Colors: ProductOptions indicated on the Drawings or selected by the Architect.
- H. Mix Water: Provide fresh, clean, clear, potable water from a domestic source. Water must conform to ASTM C 1602 and be free of oil, grease, waxy films, curing compounds, release agents, and other deleterious materials, including salts, acids, alkalis, organic materials, detergents, and other matter that might negatively affect tile quality, durability, appearance, or performance.

2.4 ACCESSORIES

- A. Trim Units: Coordinate with sizes and coursing of adjoining tile. Provide shapes indicated on the Drawings.
- B. Grout Release:
 1. Description: Temporary, water soluble, pre-grout coating.
 2. Application: Used to provide protection against grout & mortar staining.
 3. Products: Provide one of the following, or equal.
 - a. “Aqua Mix Grout Release” manufactured by Custom Building Products.

- b. “STONETECH Grout Release” manufactured by LATICRETE International, Inc.
 - c. “UltraCare Grout Release” manufactured by Mapei Corp.
- C. Cleaner: Supplied, required, recommended, or accepted by the manufacturer for use on the installed tile and actual in-service conditions applicable to the project. Cleaners must remove stains, dirt, and residue without damaging or altering tile and grout surfaces.
- D. Grout Sealer: Manufacturer's standard product for sealing grout joints, which does not change either the color or appearance of installed grouts.
- E. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.5 MIXING

- A. Site Mixing: Batch mix installation materials in conformance with manufacturer’s instructions and other requirements and recommendations, using manufacturer- recommended techniques and manufacturer-recommended mechanical mixing equipment, which must be clean and free of material from previously mixed batches before charging each subsequent batch.
 - 1. Measure mix materials using only graduated mixing containers and calibrated mixing equipment. Shovels do not qualify as graduated mixing containers or calibrated equipment and are prohibited from measuring or dispensing mix materials.
 - 2. Thoroughly agitate and stir mix materials to a uniform and smooth consistency suitable for proper installation.
 - 3. Do not reduce, alter, or introduce foreign materials into mix materials, except in conformance with manufacturer’s instructions and other requirements and recommendations.
 - 4. Do not use caked or lumpy materials; or materials that are irregular, too thick or too thin, or that are partially set.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer’s instructions and other requirements and recommendations, including dimensional tolerances and deflection criteria.
 - 2. Verify subfloor surfaces are properly secured, smooth, and flat to minimum floor flatness and levelness tolerances required, recommended, or accepted by the manufacturer for the actual in-service conditions applicable to the project.
 - 3. Verify items penetrating tile are installed.
- C. Evaluation and Assessment:

1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage; and from detrimental effects caused by surface profiling operations. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
 1. Remove substrate coatings and other substances that are incompatible with adhesives or that may negatively affect the quality of installation, durability, appearance, or performance of furnished tiling.
 2. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with leveling and patching compound. Apply, trowel, and float patching compound to achieve smooth, flat, hard surface. Prohibit traffic until patching compound is cured.
 3. Perform testing and corrective work and prepare substrates in conformance with the requirements of Section 09 05 16. Provide ICRI concrete surface profile CSP 3 to
 4. CSP 5 (light to medium shotblast between 10 and 40 mils), unless otherwise explicitly required, recommended, or accepted in writing by the waterproofing manufacturer.
 5. Vacuum-clean substrate.

3.3 INSTALLATION

- A. General Requirements:
 1. Install tile in conformance with the specified quality standards requirements using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 2. Set tile to line; plumb, level, and square without warp or lipping; with uniform, well-fitted joints and in alignment with adjacent construction
 3. Completed work must match approved samples and mockups, as accepted by the Architect.
 4. Installed tile must be warrantable. Do not install, correct, or replace tile in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 1. Install waterproofing/crack prevention membrane in conformance with ANSI A108.13 and the waterproofing/crack prevention manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
 2. Do not install tile over waterproofing/crack prevention membrane until membrane has cured and been tested to determine that it is watertight.
 3. Install tile in conformance with the ANSI and TCNA quality standard publication requirements for wall installations.

4. Accurately form intersections and returns. Perform cutting and drilling without marring visible surfaces. Carefully grind cut edges abutting trim, finishes, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 5. Jointing Pattern: Lay tile in patterns as indicated on the Drawings.
 - a. Ensure tile are the same size and joints align when tile are installed against stone on floors, bases, walls, and trim.
 - b. Lay out and center tile in both directions in each space or on each wall area. Adjust to minimize cutting.
 - c. Provide uniform joint widths, unless otherwise indicated.
 6. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, during installation..
 - a. Locate joints in tile surfaces directly above joints in concrete substrates.
 - b. Prepare joints and apply sealants in conformance with the requirements in Section 07 92 00.
 - c. Do not saw-cut joints after installing stones
 7. Thresholds: Install thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 8. Grout tile in conformance with the ANSI and TCNA quality standard publication requirements.
 9. Grout Sealer: Apply grout sealer to cementitious grout joints in conformance with the grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile by wiping with soft cloth.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely adhere tile to supporting construction.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible tile surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed tile in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on, adjacent to or against installed tile unless they are protected from damage, as accepted in writing by the Architect. Do not use installed tile as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 09 30 00

SECTION 09 51 00 – ACOUSTICAL TECTUM® SHAPES AND CLOUDS CEILINGS

1.1 SUMMARY

- A. Section Includes:
 - 1. Cementitious wood fiber plank acoustical ceiling system
 - 2. Exposed Suspension System
- B. Related Sections:
 - 1. Section 09 51 00 – Acoustical Ceilings
 - 2. Section 09 53 00 – Acoustical Ceiling Suspension Assemblies
 - 3. Section 09 20 00 – Plaster and Gypsum Board
 - 4. Section 01 81 13 – Sustainable Design Requirements
 - 5. Section 01 81 10 – Indoor Air Quality Requirements
 - 6. Division 23 – HVAC Air Distributions
 - 7. Division 26 – Electrical
- C. Alternates
 - 1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been approved by Addenda, the specified products shall be provided without additional compensation.
 - 2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - 7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
 10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
 11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum
 12. ASTM E 1264 Classification for Acoustical Ceiling Products
- B. International Building Code
- C. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
- D. NFPA 70 National Electrical Code
- E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
- F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of nonstructural components
- G. International Code Council-Evaluation Services Report – Seismic Engineer Report
- H. ESR 1308 – Armstrong Suspension Systems
- I. ICC-ES Evaluation Report ESR-1112.
- J. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010
- K. LEAD - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.3 SYSTEM DESCRIPTION

- A. Circle
1. 4' Diameter w/ paint color specified in field
 2. 2' Diameter w/ paint color specified in field

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of Tectum® Shapes and or Clouds and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of suspension system.
- C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.

- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- E. If the material supplied by the acoustical subcontractor does not conform to manufacturer's current published values it must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 SUSTAINABLE MATERIALS

- A. Transparency: Manufacturers will be given preference when they provide documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.
- B. Health Product Declaration. The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.
- C. Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).
- D. Low Emitting products with VOC emissions data. Preference will also be given to manufacturers that can provide emissions data showing their products meet CDHP Standard Method v1.1 (Section 01350).
- E. Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.
- F. End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.
- G. Products meeting LEED V4 requirements including:
 - 1. Storage & Collection of Recyclables
 - 2. Construction and Demolition Waste Management Planning
 - 3. Building Life-Cycle Impact Reduction
 - 4. Building Product Disclosure and Optimization Environmental Product Declarations
 - 5. Building Product Disclosure and Optimization Sourcing of Raw Materials
 - 6. Building Product Disclosure and Optimization Material Ingredients
 - 7. Construction and Demolition Waste Management

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide Tectum® Shapes and or Clouds and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

- C. Surface Burning Characteristics: As follows, per ASTM E 84 and complying with ASTM E 1264 Classification.
- D. Tectum® Shapes and or Clouds, as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- E. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE & HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Provide labels indicating brand name, style, size and thickness.
- C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.8 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
- B. Do not install ceiling panels until building is closed in and HVAC system is operational.
- C. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
- D. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - 1. Relative Humidity: 65 – 75%.
 - 2. Uniform Temperature 55 – 70 degrees F (13 - 21 degrees C)

1.9 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
 - 1. Defects in material or factory workmanship
- B. Tectum® Shapes and or Clouds and suspension systems one source manufacturer is Thirty (30) years from date of substantial completion.

- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Tectum® Shapes and or Clouds: Furnish quality of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

1.11 MANUFACTURER

- A. Tectum® Shapes and or Clouds:
 - 1. Tectum® by Armstrong World Industries, Inc.
- B. Suspension System:
 - 1. Armstrong World Industries, Inc.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING UNITS

- A. Acoustical Panels Type AP-1:
 - 1. Surface Texture: Coarse
 - 2. Composition: Aspen wood fibers bonded with inorganix hydraulic cement
 - 3. Color: White
 - 4. Size: 30" & 48"
 - 5. Thickness: 1-1/2"
 - 6. Edge Profile: square
 - 7. Noise Absorption; (up to 0.41 Sabins S/F)
 - 8. Flame Spread: ASTM E 1264; (Fire Class)
 - 9. Light Reflectance (LR) White Panel: ASTM E 1477
 - 10. Dimensional Stability: HumiGuard Plus
 - 11. Sustainable: EPD (Environmental Product Declaration) and HPD (Health Product Declaration)
 - 12. Acceptable Product: Tectum® Shapes and or Clouds as manufactured by Armstrong World Industries

2.2 METAL SUSPENSION SYSTEMS

- A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A653. Main beams and cross tees are double-web steel construction with 15/16" type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 - 1. Structural Classification: ASTM C 635 Intermediate duty

2. Color: (Standard White) unless noted otherwise
 3. Acceptable Product: Prelude XL 15/16" as manufactured by Armstrong World Industries
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
 - C. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three design load, but not less than 12 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

- A. Measure ceiling area and establish layout of Tectum® Shapes and or Clouds. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

- A. Install Tectum® Shapes and or Clouds in accordance manufacturer's installation instructions. Follow the requirements of the International Building Code, ASCE 7 and ASTM E580 and in install in accordance with the authorities having jurisdiction.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken Tectum® Shapes and or Clouds
- B. Clean exposed surfaces of Tectum® Shapes and or Clouds and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended acoustical ceiling panels.
 - 2. Suspension system.
 - 3. Installation materials.
 - 4. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. CISCA: Ceilings & Interior Systems Construction Association.
 - 2. ASW: American Steel and Wire Co.
 - 3. SWG: Steel Wire Gauge.
- B. Definitions:
 - 1. Manufacturer: Means the acoustical ceiling manufacturer, unless otherwise indicated.
 - 2. Ceiling: Means the ceiling finish and associated suspension systems.
 - 3. Wire Gage (Steel Wire Gage): Means the diameter of steel wire, in inches, according to dimensions established by Washburn & Moen, Roebling, or American Steel and Wire Co.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate ceiling layout and installation with adjacent construction elements that penetrate ceilings, or is supported by them, including
 - 1. light fixtures;
 - 2. HVAC equipment;
 - 3. fire-suppression system components;
 - 4. partition assemblies; and
 - 5. perimeter conditions.
- B. Sequencing:
 - 1. Schedule acoustical ceiling deliveries to the project site only after the building is enclosed with a permanent enclosure; “wet work” within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; and storage areas are broom- and vacuum-clean.
 - 2. Before beginning installation, final light fixtures must be completely installed, energized, and fully illuminated to at least the same type and level of illumination, and color temperature, maintained in the room or space after the building is occupied.
 - 3. Install acoustical ceilings only after penetrating items are installed.
 - 4. After acoustical ceiling installation, maintain ambient conditions within a range required, recommended, approved, or accepted by the manufacturer until Final Completion.

- C. Scheduling: Allow sufficient time in the construction schedule to acclimate acoustical ceilings to specified ambient conditions for at least 48 hours before installation begins.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings:
 - a. Submit dimensioned plans drawn to scale and showing acoustical ceiling layout, materials, joints, edge conditions, and finishes. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans.
 - 3. Samples:
 - a. Submit at least 8-inch square representative samples of each acoustical ceiling variety for each specified color and finish.
 - b. Submit at least 8-inch long representative samples of each suspension system exposed tee, molding, and trim variety in each specified color and finish.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Coordination Drawings: Submit at least 1/4-inch scale dimensioned reflected ceiling plans showing the following items coordinated with each other, based on input from installers of each item involved.
 - a. Ceiling suspension system members.
 - b. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - c. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 2. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished acoustical ceilings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 3. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Maintenance Material Submittals:
 - 1. Before Final Completion, deliver to the Owner acoustical ceiling cleaning materials, equipment, accessories, and instructions; and extra stock materials to replace those worn or damaged as a result of normal occupancy.

2. Furnish at least 2 percent of the total installed for each acoustical ceiling type, color, composition, grade, finish, and variety, but not less than one box or open container.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical ceilings must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

B. Regulatory Requirements:

1. Surface-Burning Characteristics: Provide acoustical ceilings having a maximum FSI Value of 25 or less and a maximum SDI Value of less than 450 (Class A), when tested in conformance with ASTM E 84.
2. Ceiling panels, other than acoustical panels, weighing more than 1/2-pound per square foot must be positively attached to ceiling suspension runners in conformance with International Building Code.

C. Quality Standards

1. Seismic Standard: Provide acoustical ceilings designed and installed to withstand the effects of earthquake motions in conformance with ASCE/SEI 7, *“Minimum Design Loads For Buildings and Other Structures”*; CISC publication, *“Seismic Construction Handbook”*; and International Building Code.
2. Installation Standard: Comply with CISC publication *“Ceiling Systems Handbook”* requirements for installation.

D. Qualifications:

1. Installer: Company or individuals must have at least 5 years’ experience installing acoustical ceilings for at least 30 previous projects similar to this project in size, material, design, and complexity.
2. Supervisors: Individuals must have at least 7 years’ experience installing acoustical ceilings for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years’ supervisory experience directing and leading acoustical ceiling installers.

1.6 HANDLING

A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.

1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
3. Unload and store only inspected and accepted items.

- B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage.
 - 1. Furnish adequate dunnage and bracing during storage.
 - 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.
 - 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
- D. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install tile only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Existing Conditions: Provide permanent lighting or illuminate work spaces to at least the same level occurring in the room or space after Final Completion.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for waterproofing products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 10 years.
- B. Installer Guarantee: Furnish to the Owner a written guarantee for waterproofing work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING PANELS

- A. Product: Indicated on the Drawings, Sheet A-059, A-060, & A-061, or equal.

2.2 SUSPENSION SYSTEMS

- A. Product: Indicated on the Drawings, Sheet A-059, A-060, & A-061, or equal.

2.3 INSTALLATION MATERIALS

- A. Attachment Devices: Sized for 5 times the design load indicated in ASTM C 635 Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
- B. Wire: Soft temper, zinc-coated, pre-stretched, galvanized carbon steel wire conforming to ASTM A 641 Class 3 or A coating and having a minimum yield-stress load of 3 times the design load.
 - 1. Hanger Wire: Minimum 0.106-inch diameter. (ASW12)
 - 2. Diagonal Bracing Wire: Minimum 0.106-inch diameter. (ASW12)
 - 3. Provide heavier gage hanger wire for ceiling systems heavier than 4 pounds per square foot.
- C. Compression Struts: Provide one of the following.
 - 1. Cold or hot rolled angles, loadbearing or non-loadbearing studs, EMT or rigid conduit, or black iron.
 - 2. Cold-rolled steel section with maximum L/R ratio of not more than 200.
- D. Engineered Compression Struts:
 - 1. Description: Pre-engineered telescoping seismic compression posts manufactured from heavy-wall galvanized tubing.
 - 2. Application: Manufactured compression struts may be provided in lieu of compression struts indicated above when installed in conformance with its manufacturer's instructions.
 - 3. Products: Provide one of the following, or equal.
 - a. "ARMSTRONG 5594 Ceiling Tile Compression Strut" manufactured by Armstrong World Industries, or equal.
 - b. "Donn Brand Compression Post VSA" manufactured by USG Interiors, Inc. (ICC ES Report No. ESR-1222), or equal.
- E. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.4 ACCESSORIES

- A. Seismic Clips:
 - 1. Description: 2-inch beam end retaining clip that joins main beam or cross tee to wall molding and web of grid with no visible pop rivets.
 - 2. Restrictions: Use of seismic clips is permitted only when specifically detailed on the Drawings. Alternative method of construction plan-review approval is required for use of seismic clips.
 - 3. Products: Provide one of the following, or equal.
 - a. "BERC 2" clips manufactured by Armstrong World Industries, or equal.

- b. “ACM7” clips manufactured by USG Interiors, Inc., or equal.
- B. Seismic Separation Joints: Provide ceiling system manufacturer’s standard at seismic separation joints at ceiling locations where the contiguous area of non-broken ceiling is 2,500 square feet or greater.
- C. Perimeter Wall Molding: Provide the following manufactured by Armstrong World Industries, or equal, with prefinished exposed flanges matching suspension system.
 - 1. Angle Molding: “No. 7808”, or equal, 2-inch flange by 2-inch high hemmed edge molding.
 - 2. Shadow Molding: “No. 7823”, or equal, 2-inch flange by 1-1/4-inch high by 3/4-inch reveal hemmed edge molding.
 - 3. Shadow Molding Installed with Seismic Clips:
 - a. Application: Compatible with Seismic Rx and BERC 2 clips.
 - b. Product: “No. 7897” 15/16-inch flange by 15/16-inch high by 1/2-inch reveal hemmed edge molding.
 - 4. Channel Molding: “No. 7834”, or equal, 15/16-inch flange by 1-1/4-inch high by 1/2-inch reveal hemmed edge molding.
- D. Perimeter Trim: “Axiom Building Perimeter System” manufactured by Armstrong World Industries, or equal, for ACT ceiling tiles flush with adjacent gypsum board soffits.
- E. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place supporting and adjacent construction conforms to the manufacturer’s requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
 - 2. Verify items penetrating acoustical ceilings are installed.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer’s instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

A. General Requirements:

1. Install acoustical ceilings using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
3. Installed acoustical ceilings must be warrantable. Do not install, correct, or replace acoustical ceilings in a manner that results in any warranty or guarantee becoming void.

B. Special Techniques:

1. Suspend ceiling hangers from building's structural members.
 - a. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - b. Do not attach hangers to steel deck tabs. Do not attach hangers to steel roof deck. Attach hangers to structural members.
2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or ceiling suspension system.
3. Space hangers not more than 48 inches on center along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - b. Where width of ducts and other construction within ceiling plenums produce hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - c. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by the quality standard publications.
4. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 - a. Secure wire hangers to ceiling suspension members and to supports above with at least 3 tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure bracing wires to ceiling suspension members and to supports with at least 4 tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.
6. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
7. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Mechanically-fasten moldings to substrates at intervals not more than 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension

- system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
8. Install ceiling panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
- a. Arrange directionally patterned ceiling panels as indicated on reflected ceiling plans. Install panels with pattern running in one direction parallel to short axis of space.
 - b. For square-edged panels, install with edges fully hidden from view by flanges of suspension system runners and moldings.
 - c. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by ceiling panel manufacturer.
 - d. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach acoustical ceilings to supporting construction.
- D. Installation Tolerances: Ceilings must conform to the following tolerances, which are non-cumulative.
- 1. Maximum Out of Plane: Surfaces may not vary by more than 1/8-inch in 10 feet.
 - 2. Carrying Channel Maximum Out of Level: Not more than 1/8-inch in 12 feet,
 - 3. Main Runner Maximum Out of Level: Not more than 1/4-inch in 10 feet,
 - 4. Main Runner Maximum Deflection: Not more than L/360 of span,
 - 5. Maximum Misalignment of Main Runners: 0.015-inch.
 - 6. Maximum Misalignment of Intersection Members: 0.020-inch.
 - 7. Main Runner Bow, Camber, and Twist: Not more than 1/32-inch in 2 feet bow or camber; not more than one degree twist.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
- 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean all visible tile surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed acoustical ceilings in place from deterioration, and damage until Substantial Completion.
- B. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 09 51 13

SECTION 09 65 14 – RESILIENT BASE

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient wall base.
 - 2. Installation materials.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the resilient base manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Schedule resilient base deliveries to the project site only after the building is enclosed with a permanent enclosure; “wet work” within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; storage areas are broom- and vacuum-clean; and the HVAC system is activated, operating, and maintaining ambient conditions at occupancy levels.
 - 2. Final light fixtures must be completely installed and energized before beginning installation.
 - 3. Install resilient base only after all other finishing operations are complete, especially overhead finishes.
 - 4. After resilient base installation, maintain ambient conditions within a range required, recommended, approved, or accepted by the manufacturer until Final Completion.
- B. Scheduling:
 - 1. Acclimation: Allow sufficient time in the construction schedule to acclimate resilient base and installation materials to specified ambient conditions for at least 48 hours before installation begins.
 - 2. Primer Installation: Resilient base must be applied within 24 hours of primer installation. Re-prime surfaces exposed for more than 24 hours; follow manufacturer’s instructions for re-priming.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.

- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished resilient base and accessories.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Maintenance Material Submittals:
 - 1. Before Final Completion, deliver to the Owner resilient base cleaning materials, equipment, accessories, and instructions; and extra stock materials to replace those worn or damaged as a result of normal occupancy.
 - 2. Furnish at least 2 percent of the total installed for each resilient base type, color, composition, grade, finish, and variety, but not less than one unopened box or container.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Resilient base must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
 - 1. Surface-Burning Characteristics: base having a maximum FSI Value of 25 or less and a maximum SDI Value of less than 450 (Class A), when tested in conformance with ASTM E 84.
 - 2. Radiant Flux Classification: resilient accessories having an average critical radiant flux value of at least 0.45 (Class I), when tested in conformance with ASTM E 648.
- C. Qualifications:
 - 1. Installer: Company or individuals must have at least 5 years' experience installing resilient base for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - 2. Supervisors: Individuals must have at least 7 years' experience installing resilient base for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading resilient base installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped, upright in their original containers, indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas. Promptly remove and replace rolled products that are flattened or distorted during shipping, unloading, or storage.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations.
 - 1. Avoid damage to containers and contamination of contents.
 - 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective resilient base with undamaged new resilient base that do not exhibit deterioration, damage, or defects, including rolled sheet products that are flattened or distorted during shipping, unloading, or storage.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install resilient base only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Existing Conditions:
 - 1. Surface Conditions: Surfaces receiving resilient base must be dry. Install resilient base only when substrate moisture content, vapor emission rate, and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 - 2. Ventilation: Maintain adequate ventilation during and after installation and curing, setting, or drying. Where natural ventilation is inadequate, use forced-air circulation or mechanical ventilation as necessary for the installations indicated.
 - 3. Illumination: Provide permanent lighting or illuminate work spaces to at least the same type, illumination level, and color temperature maintained in the room or space after the building is occupied.
- C. Other Conditions: Do not apply resilient base where dust is generated, or liquids are sprayed.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

- A. Product: Indicated on the Drawings, Sheet A-065, or equal.

2.2 INSTALLATION MATERIALS

- A. Primer: Water-based, low- or zero-VOC, solvent-free primer supplied, required, recommended, or accepted by the manufacturer for in-service installation conditions, including temperature, relative humidity, and substrate porosity; and expected foot traffic, rolling traffic, and fire-resistance ratings.
- B. Adhesive:
 - 1. Water-based, low- or zero-VOC adhesive supplied, required, recommended, or accepted by the manufacturer for ease of installation; and for adequate bonding of resilient base to substrates for all in-service installation conditions, including temperature, relative humidity, and substrate porosity; and expected foot traffic, rolling traffic, and fire-resistance ratings.
 - 2. Wet-tack, percent solids, open-time, stripability, and ease of application must be explicitly formulated for each resilient base type and application.
 - 3. Provide hard-set adhesive supplied, required, recommended, or accepted by the manufacturer under resilient base subject to concentrated static or dynamic rolling loads.

2.3 ACCESSORIES

- A. Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations. Verify wall surfaces and flooring are properly secured, smooth, and flat to minimum floor flatness and levelness tolerances required, recommended, or accepted by the manufacturer for the actual in-service conditions applicable to the project.

2. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with resilient base adhesion, appearance, or performance.
- C. Evaluation and Assessment:
1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.

3.3 INSTALLATION

- A. General Requirements:
1. Install resilient base using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 2. Only install resilient base under conditions that ensure finishes are free from blemishes and defects.
 3. Completed work must match approved samples and mockups, as accepted by the Architect.
 4. Installed resilient base must be warrantable. Do not install, correct, or replace resilient base in a manner that results in any warranty or guarantee becoming void.
- B. Resilient Base Special Techniques:
1. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 2. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 3. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 4. Do not stretch resilient base during installation.
 5. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
 6. Use straight pieces of maximum lengths possible to form corners; form without producing discoloration (whitening) at bends.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely adhere resilient base to supporting construction.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible resilient base surfaces in a manner that does not result in any warranty or guarantee becoming void.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed resilient base in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on, adjacent to, or against installed resilient base unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed resilient base as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 09 65 14

SECTION 09 65 23 – RESILIENT PLANK FLOORING

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient plank flooring.
 - 2. Surface preparation.
 - 3. Installation materials.
 - 4. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 03 35 10 for concrete flatwork finishing and curing; and for preventative MVER products.
 - 2. Section 09 05 16 for preparation of concrete slabs for finish flooring; and for remedial MVER products.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. ICRI: International Concrete Repair Institute, Inc.
 - 2. MVER: Moisture Vapor Emission Rate.
 - 3. RFCI: Resilient Floor Covering Institute.
- B. Definitions:
 - 1. Manufacturer: Means the resilient plank flooring manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Concrete Substrates:
 - a. Verify chemical and adhesive compatibility of selected flooring adhesives with installed curing compounds and installed moisture vapor emission control systems, based on current product formulations.
 - b. Coordinate existing concrete subfloor surface flatness and levelness with ACI 117 requirements, measured in conformance with ASTM E 1155 (3D laser scanning or Allen Face F-Meter methods), and tolerances required, recommended, or accepted by the flooring manufacturer.
 - 2. Wood Substrates: Verify all wood sub floors are double-layer construction, are suspended at least 18 inches above grade, and have adequate cross-ventilation.
- B. Preinstallation Meeting:
 - 1. Resilient plank flooring manufacturer's representative and installer must attend the preinstallation meeting specified in specification section 03 35 10.
 - 2. Schedule a separate additional preinstallation meeting between the Contractor, the Architect, resilient plank flooring manufacturer's representatives and installers, and the entities and individuals responsible for conducting concrete substrate testing.

3. Hold the meeting after submittal approval and at least 10 business days before beginning installation.
4. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including subfloor surface flatness and levelness, and special details and conditions that might affect installation.
5. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed resilient plank flooring. Resolve each condition.
6. Finalize construction schedule.
7. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties.

C. Sequencing:

1. Schedule resilient plank flooring deliveries to the project site only after the building is enclosed with a permanent enclosure; “wet work” within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; storage areas are broom- and vacuum-clean; and the HVAC system is activated, operating, and maintaining ambient conditions at occupancy levels.
2. Install resilient plank flooring only after substrate is cured to a condition of equilibrium; is sufficiently dry to bond with resilient plank flooring adhesives; and has alkalinity (pH), MVER, and RH within ranges required, recommended, or accepted by the manufacturer. Provide chemically and adhesively compatible treatment when required or necessary to reduce pH and MVER to within allowable limits required, recommended, or accepted by the manufacturer.
3. Final light fixtures must be completely installed and energized before beginning installation.
4. Install resilient plank flooring only after penetrating items are installed.
5. Install resilient plank flooring only after all other finishing operations are complete, especially overhead finishes.
6. After resilient plank flooring installation, maintain ambient conditions within a range required, recommended, approved, or accepted by the manufacturer until Final Completion.

D. Scheduling:

1. Concrete Curing: Allow enough time in the construction schedule for concrete to cure for at least 28 days before beginning surface preparation and installation.
2. Acclimation: Allow sufficient time in the construction schedule to acclimate resilient plank flooring and installation materials to specified ambient conditions for at least 48 hours before installation begins.
3. Primer Installation: Resilient plank flooring must be applied within 24 hours of primer installation. Re-prime surfaces exposed for more than 24 hours; follow manufacturer’s instructions for re-priming.
4. Access Restrictions: Close spaces during installation; keep closed to foot traffic after installation for at least 48 hours and to rolling traffic for at least 72 hours.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).

1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 2. Shop Drawings:
 - a. Submit dimensioned plans drawn to scale and showing resilient plank flooring custom patterns and inlays, and seam layouts.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans.
 3. Samples: Submit at least 8-inch square representative samples of each resilient plank flooring color, finish, and variety.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished resilient plank flooring.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit copies of manufacturer's instructions and other requirements and recommendations for resilient plank flooring maintenance, cleaning, and repair to the Architect as a condition of project closeout.
- D. Maintenance Material Submittals:
1. Before Final Completion, deliver to the Owner resilient plank flooring cleaning materials, equipment, accessories, and instructions; and extra stock materials to replace those worn or damaged as a result of normal occupancy.
 2. Furnish at least 2 percent of the total installed for each resilient plank flooring type, color, composition, grade, finish, and variety, but not less than one unopened box or container.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Resilient base must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.

2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Regulatory Requirements:
1. Resilient plank flooring must be stable, firm, and slip resistant, conforming to the requirements of International Building Code.
 2. Radiant Flux Classification: Provide resilient plank flooring having an average critical radiant flux value of at least 0.45 (Class I), when tested in conformance with
 3. ASTM E 648.
 4. Allowable Static Coefficient of Friction Value (SCOF): At least 0.6 for level surfaces and at least 0.8 for sloped surfaces, when measured in conformance with
- C. Quality Standards:
1. Resilient Plank Flooring Installation Standard: Comply with Resilient Floor Covering Institute publication RFCI IP #2, “Recommended Installation Practice for Vinyl Composition Plank (VCT)” requirements that apply to each in-service condition indicated.
 2. Material Standard: Resilient plank flooring must be independently tested and certified by Scientific Certification Systems (SCS) in conformance with FloorScore requirements for indoor air quality emissions.
- D. Qualifications:
1. Installer: Company or individuals must have at least 5 years’ experience installing resilient plank flooring for at least 30 previous projects similar to this project in size, material, design, and complexity.
 2. Supervisors: Individuals must have at least 7 years’ experience installing resilient plank flooring for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years’ supervisory experience directing and leading resilient plank flooring installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.
 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.

- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage.
 - 1. Avoid damage to packaging and containers, and contamination of contents.
 - 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective resilient plank flooring materials with undamaged new resilient plank flooring materials that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install resilient plank flooring only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Existing Conditions:
 - 1. Surface Conditions: Surfaces receiving resilient plank flooring must be dry. Install resilient plank flooring only when substrate moisture content, vapor emission rate, and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 - 2. Ventilation: Maintain adequate ventilation during and after installation and curing, setting, or drying. Where natural ventilation is inadequate, use forced-air circulation or mechanical ventilation as necessary for the installations indicated.
 - 3. Illumination: Provide permanent lighting or illuminate work spaces to at least the same type, illumination level, and color temperature maintained in the room or space after the building is occupied.

PART 2 - PRODUCTS

2.1 RESILIENT PLANK FLOORING

- A. Product: Indicated on the Drawings, Sheet A-062, or equal.

2.2 SURFACE PREPARATION

- A. Substrate Testing and Surface Preparation: Perform testing and corrective work and prepare substrates in conformance with the requirements of Section 09 05 16.

2.3 INSTALLATION MATERIALS

- A. Trowelable Patch and Fill Materials: Specified in Section 03 54 16, unless other products are supplied, required, recommended, or accepted by the manufacturer for actual in- service conditions applicable to the project.

- B. Moisture Vapor Transmission Reduction Coating: Specified in Section 03 35 10 (preventative) or Section 09 05 16 (remedial), unless another coating is supplied, required, recommended, accepted by the by manufacturer for actual in-service conditions applicable to the project.
- C. Primer: Water-based, low- or zero-VOC, solvent-free primer supplied, required, recommended, or accepted by the manufacturer for in-service installation conditions, including temperature, relative humidity, and substrate porosity; and expected foot traffic, rolling traffic, and fire-resistance ratings.
- D. Adhesive:
 - 1. Water-based, low- or zero-VOC adhesive supplied, required, recommended, or accepted by the manufacturer for ease of resilient plank flooring installation; and for adequate bonding of resilient plank flooring to substrates for all in-service installation conditions, including temperature, relative humidity, and substrate porosity; and expected foot traffic, rolling traffic, and fire-resistance ratings.
 - 2. Wet-tack, percent solids, open-time, stripability, and ease of application must be explicitly formulated for each resilient plank flooring type and application.
 - 3. Provide hard-set adhesive supplied, required, recommended, or accepted by the manufacturer under resilient plank flooring subject to concentrated static or dynamic rolling loads.

2.4 ACCESSORIES

- A. Cleaner: Supplied, required, recommended, or accepted by the manufacturer for use on the installed resilient plank flooring and actual in-service conditions applicable to the project. Cleaners must remove stains, dirt, and residue without damaging or altering resilient plank flooring surfaces.
- B. Floor Polish: Protective liquid polish products supplied, required, recommended, or accepted by the manufacturer for the actual in-service conditions applicable to the project.
- C. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations.

2. Verify subfloor surfaces are properly secured, smooth, and flat to minimum floor flatness and levelness tolerances required, recommended, or accepted by the manufacturer for the actual in-service conditions applicable to the project.
 3. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with resilient plank flooring adhesion, appearance, or performance.
 4. Verify items penetrating resilient plank flooring are installed.
- C. Evaluation and Assessment:
1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Protection:
1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and resilient plank flooring installation. Control and collect dust produced by grinding operations.
 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage, and from detrimental effects caused by surface profiling operations. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.
1. Remove substrate coatings and other substances that are incompatible with adhesives or that may negatively affect the quality of the installation, durability, appearance, or performance of either the furnished resilient plank flooring or adhesives.
 2. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with patch and fill materials. Apply, trowel, and float patch material to achieve smooth, flat, hard surface. Prohibit traffic until patch material is cured.
 3. Perform testing, corrective work, and substrate preparation specified in Section 09 05 16.
 4. Vacuum-clean substrate.
- C. Bond Test: Perform and document bond tests as required, recommended, or accepted by the manufacturer, must be performed and documented before beginning installation.

3.3 INSTALLATION

- A. General Requirements:
1. Install resilient base using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 2. Only install resilient base under conditions that ensure finishes are free from blemishes and defects.

3. Completed work must match approved samples and mockups, as accepted by the Architect.
 4. Installed resilient plank flooring must be warrantable. Do not install, correct, or replace resilient plank flooring in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
1. Scribe, cut, and fit resilient plank flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
 2. Extend resilient plank flooring into toe spaces, door reveals, closets, and similar openings. Extend resilient plank flooring to centerline of doors in the closed position.
 3. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient plank flooring as marked on substrates. Use pencil, chalk, or other nonpermanent, non-staining marking device. The use of markers is prohibited.
 4. Adhere resilient plank flooring to substrate using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely adhere resilient plank flooring to supporting construction.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible resilient base surfaces in a manner that does not result in any warranty or guarantee becoming void.
1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.

2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed resilient plank flooring in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on, adjacent to, or against installed resilient plank flooring unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed resilient plank flooring as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 09 65 23

SECTION 09 81 33 – ACOUSTICAL INSULATION, SEALANTS, AND ACCESSORIES

1.1 SUMMARY

- A. Section Includes:
 - 1. Concealed acoustical insulation.
 - 2. Acoustical sealants.
 - 3. Acoustical spray.
 - 4. Firestop and acoustical putty pads.
 - 5. Installation materials.
 - 6. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the acoustical insulation or accessory manufacturer, as the context admits, manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. CPVC Coordination: Not all CPVC products are identical. Different CPVC products from different manufacturers may vary in molecular weight, chlorine content and compound additives.
 - 1. Verify selected CPVC product compatibility with all products that may come into contact with selected CPVC, even if contact is inadvertent.
 - 2. Determine chemical composition of CPVC materials and compatibility of selected paints and sealants with selected CPVC materials.
 - 3. Only apply ancillary products that are specifically approved for use on the specific brand of CPVC selected for the project.
 - 4. If an ancillary product is not on a compatibility list, contact the CPVC manufacturer before use. Never assume the absence of a prohibition indicates suitability.
 - 5. Natural oil (vegetable oil or animal fat) and synthetic ester oils, or items containing natural or synthetic oil are prohibited from contacting CPVC.
 - 6. Plasticizers found in certain materials, including incompatible sealants, are prohibited from contacting CPVC.
 - 7. Surfactants found in certain materials, including soaps and detergents, are prohibited from contacting CPVC.
 - 8. Fungicides sprayed on surrounding drywall and wood framing to prevent growth of mold and mildew, are prohibited from contacting CPVC.
 - 9. Scented products, including cologne, perfume, or essential oils (e.g., peppermint oil, orange oil, spearmint oil, etc.), are prohibited from contacting CPVC. (Sometimes used for the purpose of being able to detect leaks by odor)
 - 10. Jacketing on signal-carrying wiring systems often contains plasticizers that are prohibited from contacting CPVC.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished insulation.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.5 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items as shipped, upright in their original containers, indoors within dry, well-ventilated, broom-cleaned, and partially- or permanently-enclosed storage areas.
- C. Damaged Item Replacement: Promptly remove and replace items that are deteriorated, damaged, or defective with undamaged new items that do not exhibit deterioration, damage, or defects.
- D. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.6 PROJECT CONDITIONS

- A. Existing Conditions: Surfaces receiving acoustical insulation must be dry.

PART 2 - PRODUCTS

2.1 CONCEALED ACOUSTICAL INSULATION

- A. Acoustical Blanket Insulation:
 - 1. Description: Unfaced inorganic glass-fiber blanket acoustical insulation conforming to ASTM C 665 Type I acoustical insulation (blankets without membrane coverings).
 - 2. Manufacturers: Provide one of the following, or equal.
 - a. “CertaPro AcoustaTherm” manufactured by CertainTeed Corp.
 - b. “Sound Control Batts” manufactured by Johns Manville.
 - c. “Sound Attenuation Batts/MW” manufactured by Owens Corning Fiberglass Corp.
- B. Sound Attenuating Fire Blanket Insulation:
 - 1. Description: Asbestos-free mineral fiber blanket acoustical insulation conforming to ASTM C 665 requirements for Type I acoustical insulation (blankets without membrane coverings), manufactured from slag and naturally occurring rock.
 - 2. Products: Provide one of the following, or equal.
 - a. “FIBREX Sound Attenuation Fire Batt Acoustical insulation (SAFB)” manufactured by Fibrex Insulations Inc.
 - b. “Thermafiber Sound Attenuating Fire Blankets (SAFB)” manufactured by Owens Corning.
 - c. “ROCKWOOL AFB” manufactured by Roxul Inc.

2.2 ACOUSTICAL SEALANTS

- A. Latex Sealants:
 - 1. Description: Non-sag, paintable, non-staining siliconized acrylic-latex sealant conforming to ASTM C 834 requirements for Type OP (opaque sealant), Grade NF (does not meet the requirements for low temperature flexibility of Grade 0°C classification). Verify material compatibility with adjacent materials such as chlorinated polyvinyl chloride (CPVC) pipe.
 - 2. Application: Used where indicated at exposed and concealed joints and annular spaces around through-penetrations.
 - 3. Products: Unless another type is required, recommended, or accepted by the CPVC item manufacturer, provide one of the following, or equal.
 - a. “CP 506 Smoke and Acoustic Sealant” manufactured by Hilti, Inc.
 - b. “QuietZone Acoustic Sealant” manufactured by Owens Corning.
 - c. “AC-20 FTR” manufactured by Pecora Corp.
 - d. “Tremflex 834” manufactured by Tremco, Inc.
 - e. “Sheetrock Acoustical Sealant” manufactured by USG Corp.
 - 4. Requisite Properties:
 - a. Color: White.
- B. Non-Drying, Non-Hardening, Non-Skinning Sealants:
 - 1. Description: Single-component butyl rubber sound dampening elastomeric sealant conforming to ASTM Standard D 217. Verify material compatibility with adjacent materials such as chlorinated polyvinyl chloride (CPVC) pipe.
 - 2. Application: Installed at concealed joints where indicated.
 - 3. Products: Unless another type is required, recommended, or accepted by the CPVC item manufacturer, provide one of the following, or equal.
 - a. “BA-98” manufactured by Pecora Corp.
 - b. “QuietSeal Acoustical Sealant QS-350” manufactured by Serious Materials, Inc.

- c. “Acoustical Sealant” manufactured by Tremco, Inc.
- C. Fire Rated, Non-Hardening,, Sealant:
 - 1. Description: Verify material compatibility with adjacent materials such as chlorinated polyvinyl chloride (CPVC) pipe.
 - 2. Products: Unless another type is required, recommended, or accepted by the CPVC item manufacturer, provide one of the following, or equal.
 - a. “Fire Barrier 2001 Silicone RTV Foam” manufactured by 3M.
 - b. “CP 601S Elastomeric Firestop Sealant” manufactured by HILTI.
 - c. “Firetemp CI Caulk” manufactured by Johns Manville.
 - d. “Spec Seal ES100” manufactured by Specified Technologies, Inc.
- D. Expanding Foam Sealant:
 - 1. Description: Gun-applied, expanding spray foam sealant. Verify material compatibility with adjacent materials such as chlorinated polyvinyl chloride (CPVC) pipe
 - 2. Application: Used to seal and insulate around common areas of energy loss, including foundation/sill plates, outdoor fixtures, pipe penetrations, etc.
 - 3. Products: Unless another type is required, recommended, or accepted by the CPVC item manufacturer, provide one of the following, or equal.
 - a. “GREAT STUFF PRO Gaps & Cracks” manufactured by The Dow Chemical Co.
 - b. “Polycell” manufactured by M-D Building Products, Inc.
 - c. “Expanding Foam Polyfilla” manufactured by Polyfilla.
- E. Cementitious Sealant: “Monokote Z-146” manufactured by GCP Applied Technologies, Inc., or equal.
- F. Preformed Tape Sealants:
 - 1. Fire-Resistance Rated Conditions:
 - a. Description: Compressible, self-extinguishing, UL-listed closed cell polyvinyl chloride foam tape with pressure sensitive adhesive.
 - b. Application: Installed at concealed joints in fire-resistance rated construction, where indicated.
 - c. Product: “Norseal V740FR” manufactured by Norton Performance Plastics Corp., or equal.
 - d. Requisite Properties:
 - 1) Size: One-inch minimum roll width, unless another width is indicated on the Drawings.
 - 2) Thickness: At least 1/8-inch, unless another thickness is indicated on the Drawings.
 - 3) Density: At least 9 pounds per cubic foot.
 - 4) Facing: Furnish tape in rolls with protective release liner on non-adhesive face.
 - 2. Elsewhere:
 - a. Description: Compressible, closed cell polyvinyl chloride foam tape with pressure sensitive adhesive.
 - b. Application: Installed at concealed joints, where indicated.
 - c. Product: “Norseal V730” manufactured by Norton Performance Plastics Corp., or equal.
 - d. Requisite Properties:
 - 1) Size: One-inch minimum roll width.
 - 2) Thickness: At least 3/8-inch.
 - 3) Density: At least 6 pounds per cubic foot.

- 4) Facing: Furnish tape in rolls with protective release liner on non-adhesive face.

2.3 ACOUSTICAL

- A. Description: Sprayable acrylic latex material.
- B. Application: Used where indicated at exposed and concealed static or minimally dynamic joints or gaps in wall construction.
- C. Products: Provide one of the following, or equal.
 1. “CP 572 Smoke and Acoustic Spray” or “CFS-SP WB Firestop Joint Spray” manufactured by Hilti, Inc.
 2. “Spec Seal Smoke ‘N’ Sound Sealant” manufactured by Specified Technologies, Inc.
 3. “TREMstop Smoke & Sound Sealant” or “TREMstop Acrylic” manufactured by Tremco, Inc.
- D. Requisite Properties:
 1. Spray must be mold and mildew resistant in conformance with ASTM G21.
 2. Spray must have a minimum movement capability of at least 12.5 percent.

2.4 FIRESTOP AND ACOUSTICAL PUTTY PADS

- A. Description: Sound deadening pads.
- B. Application: Used to seal the external surfaces (back side) of metallic and nonmetallic switch and receptacle boxes to reduce airborne sound transmission in interior partitions.
- C. Fire-Resistance Rated Construction (Firestop Putty Pads): Provide one of the following, or equal.
 1. “CP 617 Firestop Putty Pads” manufactured by Hilti, Inc.
 2. “Putty Pads” manufactured by International Protective Coatings
 3. “Type FSP Firestop Putty” pads by Nelson Electric.
 4. “Putty Pads” manufactured by Specified Technologies, Inc.
 5. “TREMstop MP” manufactured by Tremco, Inc.
- D. Elsewhere (Acoustical Putty Pads): Provide one of the following, or equal.
 1. “Lowry Box Pads” manufactured by Henry A. Lowry Co.
 2. “Sound Pad #68” manufactured by LH Dottie Co.

2.5 INSTALLATION MATERIALS

- A. Acoustical Insulation Hangers:
 1. Application: Used to attach acoustical insulation to clean, dry, smooth, non-porous solid surfaces.
 2. Manufacturer: Provide products manufactured by AGM Industries, Inc., or equal.
 3. Products: Provide the following, or equal.
 - a. Anchors: “TACTOO Insul-Hangers” adhesively attached spindle-type anchors.
 - b. Adhesive: “BOSS 348 Multi-Purpose Construction Adhesive” manufactured by Accumetric, LLC or other VOC-compliant acoustical insulation hanger adhesive.

- c. Acoustical insulation Standoff: One-inch “Clutch Clip”.
- d. Acoustical insulation Retaining Washers: “Style RC 200” round or “SC 250” square washers.
- 4. Requisite Properties:
 - a. Base Plate and Acoustical insulation Standoff and Retaining Washers: At least 2-inch square by at least 0.149-inch (MSG 28) base metal thickness galvanized perforated steel sheet.
 - b. Retaining Washers: At least 1-1/2-inch square or diameter by at least 0.149-inch (MSG 28) base metal thickness galvanized perforated steel sheet.
 - c. Spindle: At least 0.106-inch diameter (SWG 12), zinc-coated wire, depth to suit depth of acoustical insulation indicated.
 - d. Adhesive: Adhesive used with impaling pins must either be manufactured or accepted by the acoustical insulation hanger manufacturer. “Peel and press” hangers with self-adhering adhesive backings are prohibited.
- B. Mechanical Fasteners: Tape, staples, and other devices for fastening acoustical insulation supplied, required, recommended, or accepted by the acoustical insulation manufacturer.
- C. Hanger Wire: At least 0.106-inch diameter (SWG 12) soft temper zinc-coated wire conforming to ASTM A 641, Class 3 or A coating.
- D. Adhesive: Supplied, require, recommended, or accepted by the acoustical insulation manufacturer to bond acoustical insulation securely to substrates indicated without damaging acoustical insulation or substrates.

2.6 ACCESSORIES

- A. Joint Backing:
 - 1. Description: Extruded closed-cell polyethylene foam cylindrical sealant backings conforming to ASTM C 1330, Type C.
 - 2. Products: Provide one of the following, or equal.
 - a. “Mile High Foam” manufactured by Backer Rod Mfg. Inc.
 - b. “HBR” or “Green Rod” manufactured by Nomaco, Inc.
 - c. “NuFlex 870” manufactured by TVM Building Products.
 - 3. Performance Requirements:
 - a. Maximum Water Absorption: Not more than 0.10 grams per cubic centiliter when tested in conformance with conformance with ASTM C 1016, Procedure B.
 - b. Minimum Density: At least 24 per cubic meter when tested in conformance with conformance with ASTM D 1622.
 - c. Maximum Outgassing: Less than 1 bubble when tested in conformance with conformance with ASTM D 1253.
 - d. Minimum Compression Recovery: At least 90 percent, when tested in conformance with conformance with ASTM D 5249.
 - e. Minimum Compression Deflection: At least 20.5 percent, when tested in conformance with conformance with ASTM D 5249.
 - f. Minimum Tensile Strength: At least 200 kPa, when tested in conformance with conformance with ASTM D 1623.

- B. Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install acoustical insulation using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Extend acoustical insulation to envelop entire area insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
 - 3. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of acoustical insulation to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
 - 4. Installed acoustical insulation must be warrantable. Do not install, correct, or replace acoustical insulation in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Wall Insulation:
 - a. Install acoustical insulation in cavities formed by framing members.
 - b. Use acoustical insulation that fills the cavities. If more than one length is required to fill the cavities, then provide lengths that will produce a snug fit between ends.
 - c. Place acoustical insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

- d. Maintain 3-inch clearance around recessed lighting fixtures not rated for or protected from contact with acoustical insulation.
 - e. Stuff loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to roughly 40 percent of normal maximum volume.
 - f. For metal-framed wall cavities higher than 96 inches, support unfaced blankets mechanically and support faced blankets by taping insulation flanges to metal stud flanges.
 - 2. Ceiling Insulation:
 - a. Install blanket acoustical insulation above ceilings where indicated.
 - b. Maintain 3-inch clearance of acoustical insulation around recessed lighting fixtures.
 - 3. Acoustical Sealant Installation:
 - a. At sound-rated assemblies and elsewhere indicated, seal construction in conformance with ASTM C 919 with a continuous bead of acoustical sealant at perimeter, behind control joints, and at openings and penetrations.
 - b. Install acoustical sealant to both faces of partitions at perimeters and through penetrations.
- C. Acoustical Installation Requirements:
- 1. Application: Apply acoustical sealant where shown on drawings and the following.
 - a. Both sides and perimeter of door and window frames.
 - b. Penetrations of partitions, floors, and ceilings by piping, ventilation ducts, conduits, cables, and cable trays.
 - c. Perimeter and between joints of all sound isolating partitions, floors, and ceilings.
 - 2. Acoustical Sealant:
 - a. Use continuous beads of acoustical sealant along gypsum board face layer to seal assemblies at head, sill, perimeter, and penetrations, and joints between layers of sound isolating gypsum board construction and around the perimeter of resilient ceilings.
 - b. Comply with ASTM C 919 requirements for use of joint sealants in acoustical applications as applicable to materials and conditions indicated.
 - 3. Sheet Sealant:
 - a. In full height, sound rated, and sound sensitive walls, over back and sides of all electrical, telephone, and communication boxes with specified acoustical pads.
 - b. Verify unused knockouts are plugged before installing the pads. Mold pads tightly to the boxes and to the adjacent surfaces.
 - 4. Installation:
 - a. To seal gaps 3/8-inch in dimension and larger, pack with glass/mineral fiber batt prior to installing sealant materials.
 - b. Use compressible closed-cell foam backer rod as required. Uncompressed backer rod width should be 30 to 50 percent greater than joint width.
- D. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach acoustical insulation to supporting construction.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging

all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.

- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed acoustical insulation in place from becoming wet, deterioration, and damage until covering.
- B. Do not store anything adjacent to or against installed acoustical insulation unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed acoustical insulation as work surfaces.
- C. Remove protection when it's no longer needed and before covering.

END OF SECTION 09 81 33

SECTION 09 91 00 – PAINTING

1.1 SUMMARY

- A. Section Includes:
 - 1. Field-applied finish paint.
 - 2. Surface preparation.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 05 05 14 for shop-applied steel primers and surface preparation; and for SSPC Environmental Zone definitions.
 - 2. Section 09 97 13 for high performance coatings applied to exterior steel surfaces installed in SSPC Environmental Zones 1B, 2A and 3A, including field-applied primers and spot primers.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. DFT: Dry Film Thickness.
 - 2. GU: Gloss Unit.
 - 3. SSPC: The Society for Protective Coatings.
- B. Definitions:
 - 1. Manufacturer: Means the paint manufacturer, unless otherwise indicated.
 - 2. Paint: Means all applied materials, including fillers, primers, emulsions, enamels, varnishes, stains, lacquers, and sealers, whether used as a prime, intermediate, or finish coat.
 - 3. Coating: Means the same as paint.
 - 4. Coat: Means a layer of paint that is applied and then permitted to dry. Both back-rolling and applying wet-on-wet are one coat.
 - 5. Finish: Means an entire coating system, including all surface preparation methods, primers, coats, textures, colors, and sheens.
 - 6. Thickness: Means the total finish DFT, measured in conformance with SSPC paint application standard SSPC-PA2, "Measurement of Dry Coating Thickness with Magnetic Gages".
 - 7. Touchup: Means to correct or repair non-conforming or deficient areas to bring into conformance with the Contract Documents.
 - 8. Refinish: Means to apply a new finish to a previously-finished item or surface.
 - 9. Sheen: Means the following gloss ranges, when tested in conformance with ASTM D 523.

2 Sheen	Reference Description	5 Gloss Range	7 Test Method
Gloss Level 1 (Low Sheen)	Matte/Flat	1 to 5 GUs 1 to 10 GUs	60-degree meter 85-degree meter
Gloss Level 2 (Low Sheen)	Velvet	6 to 10 GUs 11 to 24 GUs	60-degree meter 85-degree meter
Gloss Level 3 (Medium Sheen)	Eggshell	11 to 20 GUs 25 to 35 GUs	60-degree meter 85-degree meter
Gloss Level 4 (Medium Sheen)	Satin	21 to 35 GUs >35 GUs	60-degree meter 85-degree meter
Gloss Level 5 (Medium Sheen)	Low sheen	36 to 49 GUs	60-degree meter
Gloss Level 6 (Medium Sheen)	Semi-gloss	50 to 70 GUs	60-degree meter
Gloss Level 7 (High Sheen)	Gloss	71 to 85 GUs Up to 60 GUs	60-degree meter 20-degree meter
Gloss Level 8 (High Sheen)	High-Gloss	>85 GUs >60 GUs	60-degree meter 20-degree meter

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Unless otherwise indicated, paint all surfaces throughout the Project, except the following.
 - a. Concrete.
 - b. Steel decking.
 - c. Roofing.
 - d. Insulation and its facing.
 - e. Finish hardware, except items specified with a USP finish.
 - f. Prefinished metal surfaces, including anodized aluminum, chrome plating, powder coatings, and similar pre-finished materials.
 - g. Natural finish metal surfaces, including mill finish aluminum, stainless steel, copper, bronze, brass and similar finished materials.
 - h. Walls or ceilings in concealed and inaccessible areas, including furred areas, chases, and shafts.
 - i. Moving, mechanical, or electrical parts of operating units, including valve and damper operator linkages, sensing devices, motor and fan shafts..
 - j. Nameplates and required labels, including UL, FM, and other equipment identification, performance rating, or name plates.

2. Paint all visible surfaces, including surfaces visible through registers, screens and grilles whether or not colors are designated, except where a material's natural finish is obviously intended or explicitly indicated as a surface not painted.
3. Where surfaces are not specifically indicated, paint them to match adjacent similar materials or areas.
4. Specified surface preparation, priming, and paint coats are in addition to surface preparation and shop priming indicated in other specification sections.
5. Coordinate selected paint for compatibility with primers indicated in other specification sections.
 - a. Provide prime coats that are compatible with subsequent coats or provide compatible barrier coats over incompatible primers; or completely remove primer and re-prime.
 - b. Verify chemical and adhesive compatibility of all coats within each paint finish.
6. Coordinate selected paint for compatibility with chemicals used near or on painted surfaces, including cleaning materials, accessories, and methods.
7. Proposed substitution requests and submittals that change the quality (grade) or generic chemistry of specified paint are prohibited and returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
8. Specified coverage rates and thicknesses are minimum. If manufacturer's recommended coverage rates differ from specified rates, then
 - a. consult the manufacturer's representative and obtain manufacturer- recommended coverage rates printed on manufacturer's letterhead;
 - b. assume the manufacturer-recommended coverage rates govern; and
 - c. promptly submit an RFI to the Architect for resolution; include manufacturer-recommended coverage rates with the RFI.
9. Master Painters Institute standards are insufficient for and not applicable to this project.

B. Sequencing:

1. Schedule paint deliveries to the project site only after the building is enclosed with a permanent enclosure; "wet work" within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; storage areas are broom- and vacuum-clean; and the HVAC system is activated, operating, and maintaining ambient conditions at occupancy levels.
2. Before beginning installation, final light fixtures must be completely installed, energized, and fully illuminated to at least the same type and level of illumination, and color temperature, maintained in the room or space after the building is occupied.
3. Install paint only after penetrating items are installed.
4. After paint installation, maintain ambient conditions within a range required, recommended, approved, or accepted by the manufacturer until Final Completion.

C. Scheduling:

1. Concrete Curing: Allow enough time in the construction schedule for concrete to cure for at least 28 days and dry before beginning surface preparation and installation.
2. Concrete Masonry Units: CMU walls must be painted within 30 days after building close-in.
3. Cleaning: Schedule cleaning to prevent dust and other contaminants from falling on freshly-applied paint.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Paint Schedule:
 - a. Prepare a list of specified finishes and their project locations, with selected products identified for each coat of every finish.
 - b. Identify substrates to which each specified finish is applied, including surface preparation methods and primers for each substrate.
 - 3. Samples: Submit 8-1/2-inch by 11-inch drawdown cards of each specified color and sheen. Label each card with project location.
- B. Maintenance Material Submittals:
 - 1. Before Final Completion, deliver to the Owner extra stock materials to replace those worn or damaged as a result of normal occupancy.
 - 2. Furnish one unopened gallon or container for each paint type, color, composition, grade, finish, and variety.
 - 3. Submit manufacturer-recommended cleaning materials, accessories, and manufacturer's instructions and other requirements and recommendations for maintenance and cleaning of painted surfaces, including a comprehensive list of known chemicals that should not come into contact with painted surfaces.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Paint must be obtained through one source from the same manufacturer (to ensure compatibility and a uniform appearance).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Field Samples: Include in-situ mockups as part of the work of this specification section.
 - 1. The Architect reviews field samples for conformance to the Contract Documents and approves or rejects them as the standard by which subsequent work is evaluated.
 - 2. Revise field samples and repeat reviews, including arranging all revisions and paying all revision costs, until accepted in writing by the Architect. Final acceptance of paint is made from field samples.
 - 3. After acceptance, promptly identify and protect field samples for reference until Substantial Completion.
 - 4. Approved field samples may remain part of the work after being identified for future reference.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
 - 1. Furnish adequate dunnage and bracing during storage.
 - 2. Prevent stored items from contacting the floor and from deterioration and damage.
 - 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage.
 - 1. Avoid damage to packaging and containers, and contamination of contents.
 - 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install paint only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
- B. Existing Conditions:
 - 1. Surface Conditions: Surfaces receiving paint must be dry. Install paint only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 - 2. Ventilation: Maintain adequate ventilation during and after installation and curing, setting, or drying. Where natural ventilation is inadequate, use forced-air circulation or mechanical ventilation as necessary for the installations indicated.
 - 3. Illumination: Provide permanent lighting or illuminate work spaces to at least the same level occurring in the room or space after Final Completion.
- C. Other Conditions: Do not apply paint where dust is generated, or liquids are sprayed; or when windy conditions exist that may cause paint to be blown onto vegetation or other unintended surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Vista Paint.
 - 2. Dunn Edwards.
 - 3. Benjamin Moore.

2.2 PAINT

- A. Description: 100-percent premium grade (best grade) low- and no-VOC paints, unless otherwise indicated.
- B. Products: Indicated in the Paint Products Schedule at the end of this specification section.
- C. Requisite Properties:
 - 1. Colors: ProductOptions indicated on the Drawings or selected by the Architect.
 - 2. Sheens: Provide the following, unless otherwise indicated.
 - a. Ceilings: Not more than Gloss Level 3. (Eggshell)
 - b. Trim: At least Gloss Level 6. (Gloss)
 - c. Bathroom Walls: At least Gloss Level 5. (Semi-Gloss)
 - d. Other Walls: At least Gloss Level 3. (Eggshell)

2.3 ACCESSORIES

- A. Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.4 MIXING

- A. Factory-mix paint to match approved samples and mockups accepted by the Architect.
- B. Box paint at the project site or factory-batch to ensure uniform and consistent color. This requirement includes specified maintenance materials.
- C. Open paint containers only as required for use and mix only in designated areas.
- D. Thoroughly agitate and stir materials to a uniform and smooth consistency suitable for proper installation.
- E. Do not reduce, alter, or introduce foreign materials into paint, except in conformance with manufacturer's instructions and other requirements and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with paint adhesion, appearance, or performance.
 - 3. Verify items penetrating paint are installed.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Protection:
 - 1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and paint installation.
 - 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
 - 3. Opening Protection: Close and protect drains and other openings and penetrations to prevent paint intrusion or migration of liquids.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Install paint using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Only install paint under conditions that ensure finishes are free from blemishes and defects.
 - 3. Provide smooth surfaces of uniform finish, color, appearance, and coverage. Painted surfaces with cloudiness, spotting, holidays, runs, or other imperfections are prohibited and are rejected as non-conforming work.
 - 4. Do not exceed the application rates recommended by the manufacturer.

5. Completed work must match approved samples and mockups, as accepted by the Architect.
 6. Installed paint must be warrantable. Do not install, correct, or replace paint in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
1. Produce uniform finished surfaces without substrates, undercoats, marks, or stains showing through. Produce sharp and even lines and color breaks.
 2. Paint surfaces behind movable equipment and furniture the same as adjacent exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint back sides of access panels, removable or hinged covers, and similar hinged items the same as exposed surfaces.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

- C. Remove protection when it's no longer needed and before Substantial Completion.

3.6 SCHEDULE

- A. Paint products schedule begins on the next page.

END OF SECTION 09 91 00

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
EXTERIOR SURFACES - LOW VOC				
Concrete & CMU Substrates: As specified in Section 09 96 53 - Elastomeric Coatings				
Concrete & Brick Substrates: 100% Acrylic FLAT				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop	023 Fresh Start Primer
	2 nd Coat	2000 Duratone	EVSH10 Evershield Flat	400 Regal Select Flat
	3 rd Coat	2000 Duratone	EVSH10 Evershield Flat	400 Regal Select Flat
CMU Substrates: 100% Acrylic FLAT				
	1 st Coat	018 Acrylic Block Filler	SBPR00 Blockfill	M88 Latex Block Filler
	2 nd Coat	2000 Duratone	EVSH10 Evershield Flat	400 Regal Select Flat
	3 rd Coat	2000 Duratone	EVSH10 Evershield Flat	400 Regal Select Flat
CMU Substrates: 100% Acrylic ELASTOMERIC				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop	023 Fresh Start Primer
	2 nd Coat	500 Solotex	W370 Endurawall	056 Moorlastic
	3 rd Coat	500 Solotex	W370 Endurawall	056 Moorlastic
Finished Wood Surfaces: 100% Acrylic FLAT				
	1 st Coat	4200 Terminator II	EZPR00 EZ Prime Premium	0046 Hi-Hide All Purpose Primer
	2 nd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
	3 rd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
Finished Wood Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	4200 Terminator II	EZPR00 EZ Prime Premium	0046 Hi-Hide All Purpose Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	W096Regal Soft Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	W096Regal Soft Gloss
Finished Wood Surfaces: 100% Acrylic GLOSS				
	1 st Coat	4200 Terminator II	EZPR00 EZ Prime Premium	0046 Hi-Hide All Purpose Primer
	2 nd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	NA
	3 rd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	NA

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Finished Wood Surfaces: Semi-Transparent Stain				
	1 st Coat	Olympic Maximum ST Stain	Okon WPT-3	0638 Arborcoat S/T Stain
	2 nd Coat	Olympic Maximum ST Stain	Okon WPT-3	0638 Arborcoat S/T Stain
Iron, Steel, and Galvanized Steel Surfaces: Specified in Section 09 97 13 - High Performance Steel Coatings				
Iron & Steel Substrates: 100% Acrylic GLOSS				
	1 st Coat	9600 Protec	BRPR00-1 Block Rust	M04 Acrylic Metal Primer
	2 nd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	N/A
	3 rd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	N/A
Iron & Steel Substrates: 100% Acrylic SEMI-GLOSS				
	1 st Coat	9600 Protec	BRPR00-1 Block Rust	M04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	402 Regal Soft Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	402 Regal Soft Gloss
Galvanized Steel & Aluminum Substrates: 100% Acrylic GLOSS				
	Pretreatment	Krud Kutter Metal Etch	ME01 Etch	Jasco Prep N Prime
	1 st Coat	4800 Metal Pro Primer	GAPR00 Galv-Alum Premium	P04 Acrylic Metal Primer
	2 nd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	N/A
	3 rd Coat	8500 Carefree Gloss	EVSH60 Evershield Gloss	N/A
Galvanized Steel & Aluminum Substrates: 100% Acrylic SEMI-GLOSS				
	Pretreatment	Krud Kutter Metal Etch	ME01 Etch	Jasco Prep N Prime
	1 st Coat	4800 Metal Pro Primer	GAPR00 Galv-Alum Premium	P04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	W096 Regal Soft Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	W096 Regal Soft Gloss

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
<u>Zinc Alloy Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	Pretreatment	Krud Kutter Metal Etch	ME01 Etch	Jasco Prep N Prime
	1 st Coat	4800 Metal Pro Primer	GAPR00 Galv-Alum	P04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	EVSH10 Evershield Semi Gloss	W096 Regal Soft Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	EVSH50 Evershield Semi Gloss	W096 Regal Soft Gloss
<u>Fiber Cement Board Surfaces:</u> 100% Acrylic FLAT				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop	N023 Fresh Start Primer
	2 nd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
	3 rd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
<u>Portland Cement Plaster (Stucco) Surfaces (Does not apply to Polymer-Modified Plaster Surfaces):</u> Specified in Section 09 96 53 - Elastomeric Coatings				
<u>Gypsum Soffit Board Surfaces:</u> 100% Acrylic FLAT				
	1 st Coat	4600 Uniprime II	Inter-Kote Premium IKPR00	N023 Fresh Start Primer
	2 nd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
	3 rd Coat	2000 Duratone	EVSH10 Evershield Flat	W105 Regal Select Flat
INTERIOR SURFACES - LOW VOC				
<u>Concrete Surfaces:</u> 100% Acrylic FLAT				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop	N023 Fresh Start Primer
	2 nd Coat	7100 Acriglo Flat	SSHL10 Spartashield Flat	547 Regal Select Flat
	3 rd Coat	7100 Acriglo Flat	SSHL10 Spartashield Flat	547 Regal Select Flat
<u>Concrete Surfaces:</u> 100% Acrylic EGGSHELL				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	7500 Acriglo Eggshell	SSHL30 Spartashield Eggshell	550 Regal Select Pearl
	3 rd Coat	7500 Acriglo Eggshell	SSHL30 Spartashield Eggshell	550 Regal Select Pearl

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Concrete Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
Concrete Surfaces: 100% Acrylic GLOSS				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
Concrete Surfaces: 100% Epoxy GLOSS				
	1 st Coat	4600 Uniprime II	Rust Oleum Sierra S70/S71 W	N023 Fresh Start Primer
	2 nd Coat	Rust-Oleum Sierra S60 Gloss WB Epoxy	Rust-Oleum Sierra S60 Gloss WB Epoxy	P43 Super Spec HP Gloss Epoxy
CMU Surfaces: 100% Acrylic Flat				
	1 st Coat	018 Acrylic Block Filler	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	7100 Acriglo Flat	SSHL10 Spartashield Flat	547 Regal Select Flat
	3 rd Coat	7100 Acriglo Flat	SSHL10 Spartashield Flat	547 Regal Select Flat
CMU Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	018 Acrylic Block Filler	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	7500 Acriglo Eggshell	SSHL30 Spartashield Eggshell	550 Regal Select Pearl
	3 rd Coat	7500 Acriglo Eggshell	SSHL30 Spartashield Eggshell	550 Regal Select Pearl
CMU Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	018 Acrylic Block Filler	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
CMU Surfaces: 100% Acrylic GLOSS				
	1 st Coat	040 Block Kote	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
CMU Surfaces: 100% Epoxy GLOSS				
	1 st Coat	040 Block Kote	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	Rust-Oleum Sierra S60 Gloss WB Epoxy	Rust-Oleum Sierra S60 Gloss WB Epoxy	P43 Super Spec HP Gloss Epoxy
Ferrous Metal Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	9600 Protec	BRPR00 Bloc-Rust	P04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
Ferrous Metal Surfaces: 100% Acrylic GLOSS				
	1 st Coat	9600 Protec	UGPR0C Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss
Aluminum Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	9600 Protec	BRPR00 Bloc-Rust	P04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
Aluminum Surfaces: 100% Acrylic GLOSS				
	1 st Coat	9600 Protec	UGPR0C Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss
Stainless Steel, Copper, and Brass Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	9600 Protec	BRPR00 Bloc-Rust	P04 Acrylic Metal Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SSHL50 Spartashield Semi-Gloss	551 Regal Select Semi Gloss
Stainless Steel, Copper, and Brass Surfaces: 100% Acrylic GLOSS				
	1 st Coat	9600 Protec	UGPR0C Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 6C Evershield Gloss	794 Advance High Gloss

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
<u>Rough Sawn Wood Surfaces:</u> Semi-Transparent Stain				
	1 st Coat	Olympic S/T Stain	Okon WPT-3	0638 Arborcoat S/T Stain
	2 nd Coat	Olympic S/T Stain	Okon WPT-3	0638 Arborcoat S/T Stain
<u>Finished Wood Surfaces:</u> Semi-Transparent Stain				
	1 st Coat	VWS0250 Series ST Stain	Old Masters Wood Stain	Moore's S/T WB Stain
<u>Finished Wood Surfaces:</u> Clear Lacquer Finish				
	1 st Coat	NRS 1620 Sanding Sealer	LQX 101-0 Sanding Sealer	NRS 1620 Sanding Sealer
	2 nd Coat	NRF 1626 Satin Lacquer	LQX 104-0 Satin Lacquer	NRF 1626 Satin Lacquer
	3 rd Coat	NRF 1626 Satin Lacquer	LQX 103-0 Satin Lacquer	NRF 1626 Satin Lacquer
<u>Finished Wood Surfaces:</u> Water White Finish (for light-colored stains)				
	1 st Coat	NAF 1420 Satin Sealer	LQX 131-0 Sanding Sealer	NAF 1420 Satin Sealer
	2 nd Coat	NAF 1422 Satin Lacquer	LQX 132-0 Satin Lacquer	NAF 1426 Satin Lacquer
	3 rd Coat	NAF 1422 Satin Lacquer	LQX 132-0 Satin Lacquer	NAF 1426 Satin Lacquer
<u>Finished Wood Surfaces:</u> Clear Varnish Finish FLAT				
	1 st Coat	Zenith PKF7501 Flat	Zenith PKF7501 Flat	Zenith PKF7501 Flat
	2 nd Coat	Zenith PKF7501 Flat	Zenith PKF7501 Flat	Zenith PKF7501 Flat
	3 rd Coat	Zenith PKF7501 Flat	Zenith PKF7501 Flat	Zenith PKF7501 Flat
<u>Finished Wood Surfaces:</u> Clear Varnish Finish SEMI-GLOSS				
	1 st Coat	Zenith PKF7501 Flat	Zenith PKF7502 Satin	Zenith PKF7502 Satin
	2 nd Coat	Zenith PKF7501 Flat	Zenith PKF7502 Satin	Zenith PKF7502 Satin
	3 rd Coat	Zenith PKF7501 Flat	Zenith PKF7502 Satin	Zenith PKF7502 Satin
<u>Finished Wood Surfaces:</u> Clear Varnish Finish GLOSS				
	1 st Coat	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss
	2 nd Coat	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss
	3 rd Coat	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss	Zenith PKC7509 Gloss
<u>Finished Wood Surfaces:</u> 100% Acrylic LOW SHEEN				
	1 st Coat	4200 Terminator II	UGPR00 Ultra-Grip	0046 Hi-Hide All Purpose Primer
	2 nd Coat	1750 Acriglo Low Sheen	SPMA20 Suprema VS	549 Regal Select Eggshell
	3 rd Coat	1750 Acriglo Low Sheen	SPMA20 Suprema VS	549 Regal Select Eggshell

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
<u>Finished Wood Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	4200 Terminator II	UGPR00 Ultra-Grip	0046 Hi-Hide All Purpose Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
<u>Finished Wood Surfaces:</u> 100% Acrylic Dryfall FLAT				
	1 st Coat	DF 12 Dryfall Flat	W 6079 Aquafall Flat	M53 Dryfall Flat
	2 nd Coat	DF 12 Dryfall Flat	W 6079 Aquafall Flat	M53 Dryfall Flat
<u>Particle Board, MDF, and Hardboard Surfaces:</u> 100% Acrylic FLAT				
	1 st Coat	4000 Uniprime II	UGPR00 Ultra-Grip	N023 Fresh Start Primer
	2 nd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
	3 rd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
<u>Particle Board, MDF, and Hardboard Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	4000 Uniprime II	UGPR00 Ultra-Grip	N023 Fresh Start Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
<u>Particle Board, MDF, and Hardboard Surfaces:</u> 100% Acrylic GLOSS				
	1 st Coat	4000 Uniprime II	UGPR00 Ultra-Grip	N023 Fresh Start Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
<u>Portland Cement Plaster Surfaces:</u> 100% Acrylic FLAT				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
	3 rd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
<u>Portland Cement Plaster Surfaces:</u> 100% Acrylic EGGSHELL				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	7500 Acriglo Eggshell	SPMA30 Suprema LS	550 Regal Select Pearl
	3 rd Coat	7500 Acriglo Eggshell	SPMA30 Suprema LS	550 Regal Select Pearl

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Portland Cement Plaster Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium SPMA50 Suprema Semi	N023 Fresh Start Primer
	2 nd Coat	7000 Acriglo Semi-Gloss	Gloss SPMA50 Suprema Semi	551 Regal Select Semi Gloss
	3 rd Coat	7000 Acriglo Semi-Gloss	Gloss	551 Regal Select Semi Gloss
Portland Cement Plaster Surfaces: 100% Acrylic GLOSS				
	1 st Coat	4600 Uniprime II	ESPR00 Eff-Stop Premium	N023 Fresh Start Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
Portland Cement Plaster Surfaces: 100% Epoxy GLOSS				
	1 st Coat	4600 Uniprime II	Rust-Oleum S70/S71 WB	N023 Fresh Start Primer
	2 nd Coat	Rust-Oleum Sierra S60 Gloss WB Epoxy	Rust-Oleum Sierra S60 Gloss WB Epoxy	P43 Super Spec HP Gloss Epoxy
Gypsum Board Surfaces: 100% Acrylic FLAT				
	1 st Coat	N/A	VNPR00 Vinylastic Premium	N
	2 nd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
	3 rd Coat	7100 Acriglo Flat	SPMA10 Suprema Flat	547 Regal Select Flat
Gypsum Board Surfaces: 100% Acrylic LOW SHEEN				
	1 st Coat	5001 Vpro Primer	VNPR00 Vinylastic Premium	N023 Fresh Start Primer
	2 nd Coat	5200 Vpro Low Sheen	SPMA20 Suprema VS	549 Regal Select Eggshell
	3 rd Coat	5200 Vpro Low Sheen	SPMA20 Suprema VS	549 Regal Select Eggshell
Gypsum Board Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	5001 Vpro Primer	VNPR00 Vinylastic Premium	N023 Fresh Start Primer
	2 nd Coat	5300 Vpro Eggshell	SPMA30 Suprema LS	550 Regal Select Pearl
	3 rd Coat	5300 Vpro Eggshell	SPMA30 Suprema LS	550 Regal Select Pearl

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Gypsum Board Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	VNPR00 Vinylastic Premium	N023 Fresh Start Primer
	2 nd Coat	5400 Vpro Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	SPMA50 Suprema Semi Gloss	551 Regal Select Semi Gloss
Gypsum Board Surfaces: 100% Acrylic GLOSS				
	1 st Coat	5001 Vpro Primer	VNPR00 Vinylastic Premium	N023 Fresh Start Primer
	2 nd Coat	8500 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
	3 rd Coat	8501 Carefree Gloss	EVSH 60 Evershield Gloss	794 Advance High Gloss
Gypsum Board Surfaces: 100% Epoxy GLOSS				
	1 st Coat	5001 Vpro Primer	Rust-Oleum Sierra S70/S71 WB Epoxy Acrylic Primer	N/A
	2 nd Coat	Rust-Oleum Sierra S60 Gloss WB Epoxy	Rust-Oleum Sierra S60 Gloss WB Epoxy	N/A
Acoustical Tile Surfaces: 100% Acrylic FLAT				
	1 st Coat	013 Acoustic Kote	W 615 Acoustikote	258 Moore's Ceiling White
	2 nd Coat	013 Acoustic Kote	W 615 Acoustikote	258 Moore's Ceiling White
I N T E R I O R S U R F A C E S - Z E R O V O C				
Concrete Surfaces: Acrylic FLAT				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	3 rd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
Concrete Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
	3 rd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Concrete Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
CMU Surfaces: Acrylic FLAT				
	1 st Coat	040 Block Kote	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	3 rd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
CMU Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	040 Block Kote	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
	3 rd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
CMU Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	040 Block Kote	SBPR00 Blockfill	160 Latex Block Filler
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
Iron & Steel Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	9600 Protec	UGPR00 Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
Aluminum Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	4800 Metal Pro Primer	UGPR00 Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
<u>Stainless Steel, Copper, and Brass Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	4800 Metal Pro Primer	UGPR00 Ultra-Grip	P04 Acrylic Metal Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
<u>Finished Wood Surfaces:</u> 100% Acrylic EGGSHELL				
	1 st Coat	5001 Vpro Primer	UGPR00 Ultra-Grip	511 Natura Primer
	2 nd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
	3 rd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
<u>Finished Wood Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	UGPR00 Ultra-Grip	511 Natura Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
<u>Particle Board, MDF, and Hardboard Surfaces:</u> Acrylic FLAT				
	1 st Coat	5001 Vpro Primer	UGPR00 Ultra-Grip	511 Natura Primer
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	3 rd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
<u>Particle Board, MDF, and Hardboard Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	UGPR00 Ultra-Grip	511 Natura Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
Portland Cement Plaster Surfaces: Acrylic FLAT				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	3 rd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
Portland Cement Plaster Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
	3 rd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
Portland Cement Plaster Surfaces: 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
Gypsum Board Surfaces: Acrylic FLAT				
	1 st Coat	Not Required	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	3 rd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
Gypsum Board Surfaces: 100% Acrylic EGGSHELL				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell
	3 rd Coat	5300 Vpro Eggshell	EVER 30 Everest Eggshell	513 Natura Eggshell

SUBSTRATE	NO. OF COATS	VISTA PAINT	DUNN-EDWARDS	BENJAMIN MOORE
<u>Gypsum Board Surfaces:</u> 100% Acrylic SEMI-GLOSS				
	1 st Coat	5001 Vpro Primer	VNSL00 Vinylastic Select Primer	511 Natura Primer
	2 nd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
	3 rd Coat	5400 Vpro Semi-Gloss	EVER 50 Everest Semi Gloss	514 Natura Semi Gloss
<u>Acoustical Tile Surfaces:</u> Acrylic FLAT				
	1 st Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat
	2 nd Coat	5100 Vpro Flat	EVER 10 Everest Flat	512 Natura Flat

SECTION 09 97 13 – HIGH-PERFORMANCE STEEL COATINGS

1.1 SUMMARY

- A. Section Includes:
 - 1. Field-applied high-performance steel coatings applied to exterior exposed-in-service ferrous metal (iron and steel) surfaces installed within (SSPC Environmental Zones 1B, 2A, and 2B).
 - 2. Surface preparation.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.
- B. Related Requirements:
 - 1. Section 05 05 14 for shop-applied steel primers and surface preparation; and for SSPC Environmental Zone definitions.
 - 2. Section 09 91 00 for painting interior steel surfaces installed in SSPC Environmental Zones 0 and 1A, including field-applied primers and spot primers.

1.2 RELATED DOCUMENTS

- A. This specification supplements the requirements of Section 05 05 14 to define complete high-performance steel coating systems.

1.3 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the high-performance coating manufacturer, unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selected coating for compatibility with chemicals used near or on coated surfaces, including cleaning materials, accessories, and methods.
 - 2. Proposed substitution requests and submittals that change the quality (grade) or generic chemistry of specified high-performance coatings are prohibited and returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
 - 3. Specified coverage rates and thicknesses are minimum. If manufacturer's recommended coverage rates differ from specified rates, then
 - a. consult the manufacturer's representative and obtain manufacturer- recommended coverage rates printed on manufacturer's letterhead;
 - b. assume the manufacturer-recommended coverage rates govern; and

- c. promptly submit an RFI to the Architect for resolution; include manufacturer-recommended coverage rates with the RFI.
4. Master Painters Institute standards are insufficient for and not applicable to this project.

1.5 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 1. Product Data:
 - a. Submit manufacturer's product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
 2. Samples: Submit 8-1/2-inch by 11-inch drawdown cards of each specified color and sheen. Label each card with project location.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished high-performance coatings.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout.
 1. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.
- D. Maintenance Material Submittals:
 1. Before Final Completion, deliver to the Owner extra stock materials to replace those worn or damaged as a result of normal occupancy.
 2. Furnish one unopened gallon or container for each paint type, color, composition, grade, finish, and variety.
 3. Submit manufacturer-recommended cleaning materials, accessories, and manufacturer's instructions and other requirements and recommendations for maintenance and cleaning of painted surfaces, including a comprehensive list of known chemicals that should not come into contact with painted surfaces.

1.6 QUALITY ASSURANCE

- A. Qualifications Source:

1. Installer: Company or individuals must have at least 5 years' experience installing high-performance coatings for at least 30 previous projects similar to this project in size, material, design, and complexity. Only a company certified by the SSPC as having a current QP1 certification may apply high-performance coatings.
 2. Supervisors: Individuals must have at least 7 years' experience installing high-performance coatings for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading high-performance coating installers.
- B. Mockups: If an ex-situ exterior wall integrated mockup is required for this project, then integrate high-performance coatings into the mockup as part of the work of this specification section.

1.7 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor and from deterioration and damage.
 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage.
1. Avoid damage to packaging and containers, and contamination of contents.
 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective high-performance coatings with undamaged new high-performance coatings that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.8 PROJECT CONDITIONS

- A. Ambient Conditions: Install high-performance coatings only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.

- B. Existing Conditions:
 - 1. Surface Conditions: Surfaces receiving high-performance coatings must be dry. Install high-performance coatings only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 - 2. Other Conditions: Do not apply high-performance coatings where dust is generated, or liquids are sprayed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Carboline Co.
 - 2. PPG Industries, Inc.
 - 3. Tnemec Co.

2.2 HIGH PERFORMANCE COATING

- A. Shop Primer: Specified in Section 05 05 14.
- B. Spot Primer for Unprimed and Zinc-Rich-Primed Surfaces:
 - 1. Description: Zinc-rich organic primer conforming to SSPC-Paint 20 Type II (Organic) zinc-rich primers and AISC requirements for Class B surface slip coefficient rating (minimum mean slip coefficient of at least 0.50).
 - 2. Product: "94-H20 Hydro-Zinc" manufactured by the Tnemec Co., or equal.
 - 3. Requisite Properties:
 - a. Minimum Thickness: Apply to a DFT of between 2.5 and 3.5 mils, when measured in conformance with SSPC paint application standard SSPC-PA2, "Measurement of Dry Coating Thickness with Magnetic Gages".
 - b. Colors: Reddish-gray or other standard color furnished by the primer manufacturer.
 - 4. Performance Requirements:
 - a. Zinc Dust Pigment: ASTM D 520 Type III composition classification (maximum 0.002 percent lead).
 - b. Dry Film Adhesion: At least 800 pounds per square inch pull, when tested in conformance with ASTM D 4541.
 - c. Humidity Resistance: No blistering, cracking, rusting, or film delamination after at least 1,000 hours exposure, when tested in conformance with ASTM D 4585.
 - d. Salt Spray Resistance: No blistering, cracking, rusting, or film delamination; nor more than 1/32-inch rust creep at scribe after at least 10,000 hours exposure, when tested in conformance with ASTM B 117.
- C. Spot Primer for Other Shop-Primed Surfaces: Provide spot primer identical to the Section 05 05 14 shop primer originally used to prime metal surfaces.
- D. Intermediate Coat:
 - 1. Product: "Hi-Build Epoxoline II Series L69" manufactured by the Tnemec Co., or equal.
 - 2. Requisite Properties:

- a. Material: 2-component polyamidoamine epoxy.
 - b. Minimum Thickness: Apply to a DFT of between 6.0 and 10.0 mils per coat, when measured in conformance with SSPC paint application standard SSPC-PA2, "Measurement of Dry Coating Thickness with Magnetic Gages".
 - c. Color: Match Tnemec color 10BL, "Cornflower".
 - d. Specular Gloss (Sheen): Satin.
3. Performance Requirements:
- a. Dry Film Adhesion: Minimum rating of 5, when tested in conformance with ASTM D 3359.
 - b. Humidity Resistance: No blistering, cracking, rusting or delaminating of film after minimum 1,000 hours exposure, when tested in conformance with ASTM D 4585.
 - c. Salt Spray Resistance: No blistering, cracking, rusting, or delaminating of film; and not more than 3/16-inch rust creep at scribe after 10,000 hours exposure, when tested in conformance with ASTM B 117.

E. Urethane Topcoat:

- 1. Application: Applied to handrails, guardrails, and other surfaces subject to wear and that require ongoing maintenance re-coating.
- 2. Product: "1095 Endura-Shield" manufactured by the Tnemec Co., or equal.
- 3. Requisite Properties:
 - a. Material: Aliphatic acrylic polyurethane.
 - b. Minimum Thickness: Apply to a DFT of between 3.0 and 6.0 mils per coat, when measured in conformance with SSPC paint application standard SSPC-PA2, "Measurement of Dry Coating Thickness with Magnetic Gages".
 - c. Color: Product Options indicated on the Drawings or selected by the Architect.
 - d. Specular Gloss (Sheen): Semi-gloss.
- 4. Performance Requirements:
 - a. Dry Film Adhesion: At least 1,260 pounds per square inch pull, when tested in conformance with ASTM D 441, (Method E, Type V Tester) , average of 3 tests.
 - b. Humidity Resistance: No blistering, cracking, rusting, or delaminating of film after minimum 5,000 hours exposure, when tested in conformance with ASTM D 4585.
 - c. UV Resistance: No blistering, cracking, or delamination, and not less than 58 percent gloss retention or 15.2 units gloss change and 1.40 DECIE2000 color change (white) after 4,000 hours exposure.
 - d. Salt Spray Resistance: No blistering, cracking, rusting, or delaminating of film; or rust creep after 5,000 hours exposure, when tested in conformance with
 - e. ASTM B 117.

F. Fluoropolymer Topcoat:

- 1. Application: Applied elsewhere at the building.
- 2. Product: "Fluoronar Series 1070" manufactured by the Tnemec Co., or equal.
- 3. Requisite Properties:
 - a. Generic Type: 2-component thermoset solution fluoropolymer top coat.
 - b. Minimum Thickness: Apply to a DFT of between 2.0 and 3.0 mils per coat, when measured in compliance with SSPC paint application standard SSPC-PA2, "Measurement of Dry Coating Thickness with Magnetic Gages".
 - c. Color: As scheduled at the end of this specification Section.
 - d. Specular Gloss (Sheen): Semi-gloss.
- 4. Performance Requirements:
 - a. Dry Film Adhesion: Must achieve a minimum rating of at least 5, when tested in compliance with ASTM D 3359.

- b. Humidity Resistance: No blistering, cracking, rusting or delaminating of film after minimum 1,000 hours exposure, when tested in compliance with ASTM D 4585.
- c. Salt Spray Resistance: No blistering, cracking, rusting, or delaminating of film; and not more than 3/16-inch rust creep at scribe after 10,000 hours exposure, when tested in compliance with ASTM B 117.

2.3 SURFACE PREPARATION

- A. Unprimed Iron and Steel Surfaces:
 - 1. Normally-Dry Interior Exposed-In-Service Conditions: Prepare surfaces in conformance with the primer manufacturer's application instructions and SSPC-SP-3, "Power Tool Cleaning".
 - 2. Elsewhere: Prepare surfaces in conformance with primer manufacturer's application instructions and SSPC-SP-11, "Power Tool Cleaning to Bare Metal".
- B. Shop-Primed Iron and Steel Surfaces:
 - 1. Clean damaged primer areas and prepare damaged primer and adjacent surfaces in conformance with the steel coating manufacturer's application instructions and SSPC-SP-11, "Power Tool Cleaning to Bare Metal".
 - 2. Sand smooth and re-clean.
 - 3. Spot-prime bare metal surfaces with specified spot-primer applied to a minimum total spot primer DFT of between 2.5 and 3.5 mils.
 - 4. Overlap undamaged primer areas with spot primer a minimum of at least 2 inches.
- C. Unknown or Incompatible Primer: Apply full prime coat of specified spot primer on all surfaces as a tie-coat for subsequent intermediate and top coats.

2.4 ACCESSORIES

- A. Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.5 MIXING

- A. Open high-performance coating containers only as required for use and mix only in designated areas.
- B. Thoroughly agitate and stir materials to a uniform and smooth consistency suitable for proper installation.
- C. Do not reduce, alter, or introduce foreign materials into high-performance coatings, except in conformance with manufacturer's instructions and other requirements and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with paint adhesion, appearance, or performance.
 - 3. Verify items penetrating paint are installed.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Protection:
 - 1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and paint installation.
 - 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
 - 3. Opening Protection: Close and protect drains and other openings and penetrations to prevent paint intrusion or migration of liquids.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Install high-performance coatings using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer- recommended accessories and techniques.
 - 2. Only install high-performance coatings under conditions that ensure finishes are free from blemishes and defects.
 - 3. Provide smooth surfaces of uniform finish, color, appearance, and coverage. high-performance coating surfaces with cloudiness, spotting, holidays, runs, or other imperfections are prohibited and are rejected as non-conforming work.

4. Do not exceed the application rates recommended by the manufacturer.
5. Completed work must match approved samples and mockups, as accepted by the Architect.
6. Installed high-performance coatings must be warrantable. Do not install, correct, or replace high-performance coatings in a manner that results in any warranty or guarantee becoming void.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect high-performance coatings in place from soiling, deterioration, and damage until Substantial Completion.

- B. Do not store anything on, adjacent to, or against high-performance coatings unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed high-performance coatings as work surfaces.

END OF SECTION 09 97 13

SECTION 09 97 13 – PENETRATING CONCRETE FLOOR SEALER

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrating concrete floor sealer.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the concrete sealer manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify chemical and adhesive compatibility of selected concrete sealer with installed curing compounds and installed moisture vapor emission control systems, based on current product formulations.
 - 2. Coordinate selected sealer for compatibility with chemicals used near or on coated surfaces, including cleaning materials, accessories, and methods.
 - 3. Proposed substitution requests and submittals that change the quality (grade) or generic chemistry of specified concrete sealers are prohibited and returned to the Contractor without review or responsive action, except to record non-conformance with this requirement.
 - 4. Specified coverage rates and thicknesses are minimum. If manufacturer's recommended coverage rates differ from specified rates, then
 - a. consult the manufacturer's representative and obtain manufacturer- recommended coverage rates printed on manufacturer's letterhead;
 - b. assume the manufacturer-recommended coverage rates govern; and
 - c. promptly submit an RFI to the Architect for resolution; include manufacturer-recommended coverage rates with the RFI.
- B. Sequencing:
 - 1. Install concrete sealers only after concrete is cured to a condition of equilibrium; is sufficiently dry to bond with concrete sealers; and has alkalinity (pH), MVER, and RH within ranges required, recommended, or accepted by the manufacturer.
 - 2. Either delay concrete sealer installation until after joint sealant installation is complete, or protect sealant bond surfaces to prevent concrete sealer migration onto joint surfaces. concrete sealer application may only precede sealant application after sealant adhesion and compatibility are tested and verified using substrates, concrete sealers, and sealant materials identical to those used in the work.
- C. Scheduling: Allow enough time in the construction schedule for concrete to cure for at least 28 days before beginning surface preparation and installation.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
- B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished concrete sealers.
 - a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
 - 2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below.
- C. Maintenance Material Submittals:
 - 1. Before Final Completion, deliver to the Owner extra stock materials to replace those worn or damaged as a result of normal occupancy.
 - 2. Furnish one unopened gallon or container for each concrete sealer type, color, composition, grade, finish, and variety.
 - 3. Submit manufacturer-recommended cleaning materials, accessories, and manufacturer's instructions and other requirements and recommendations for maintenance and cleaning of sealed surfaces, including a comprehensive list of known chemicals that should not come into contact with sealed surfaces.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer: Company or individuals must have at least 5 years' experience installing concrete sealers for at least 30 previous projects similar to this project in size, material, design, and complexity.
 - 2. Supervisors: Individuals must have at least 7 years' experience installing concrete sealers for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading concrete sealer installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.

3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
 1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor and from deterioration and damage.
 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage.
 1. Avoid damage to packaging and containers, and contamination of contents.
 2. Rotate inventory; do not use items the shelf life of which is expired.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective high-performance coatings with undamaged new high-performance coatings that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install high-performance coatings only when ambient temperature, RH, and other environmental conditions fall within ranges required, recommended, or accepted by the manufacturer.
 1. Do not install concrete sealers during rain or snow, fog or mist; or when rain or snow is predicted within 24 hours of installation.
 2. Proceed only when there is no threat of impending precipitation, and both current and forecasted weather conditions conform to those required, recommended, or accepted by the manufacturer.
 3. Do not apply concrete sealers when
 - a. ambient temperature is below 45 deg. F or more than 90 deg. F during application, and for at least 8 hours after;
 - b. surface temperatures are less than 40 deg. F or greater than 120 deg. F; and
 - c. surface temperatures are 5 deg. F or less above the dew point.
- B. Existing Conditions:
 1. Surface Conditions: Surfaces receiving concrete sealers must be dry. Install concrete sealers only when substrate moisture content and surface temperature fall within ranges required, recommended, or accepted by the manufacturer.
 2. Other Conditions: Do not apply concrete sealers where dust is generated, or liquids are sprayed; or when windy conditions exist that may cause concrete sealers to be blown onto vegetation or other unintended surfaces.
 - 3.

PART 2 - PRODUCTS

2.1 PENETRATING CONCRETE FLOOR SEALER

- A. Description: Clear-drying, water-based silane or siloxane water repellent sealer for interior exposed concrete slabs.
- B. Product: “Sure Klean Weather Seal Siloxane WB Concentrate” manufactured by PROSOCO, Inc., or equal.
 - 1. Porous Surfaces (e.g., Concrete Brick, Concrete Pavers, and Concrete Tile): Dilute to 1 part concentrate to not more than 7 parts water.
 - 2. Semi-Porous Surfaces (e.g., Cast-in-Place Concrete, Precast Concrete, Clay Brick, Terra Cotta, and Unpolished Sandstone): Dilute to 1 part concentrate to not more than 9 parts water.
 - 3. Dense Surfaces: Dilute to 1 part concentrate to not more than 14 parts water.
- C. Requisite Properties: When compared visually to an untreated sample under the same lighting conditions, concrete sealers may not alter the color or sheen of the coated substrate and must be invisible after application and over the life of the substrate. Confirm visual appearance by mockups and adjust products and applications as required.

2.2 ACCESSORIES

- A. Mix Water: Provide fresh, clean, clear, potable water from a domestic source. Water must conform to ASTM C 1602 and be free of oil, grease, waxy films, curing compounds, release agents, and other deleterious materials, including salts, acids, alkalis, organic materials, detergents, and other matter that might negatively affect tile quality, durability, or performance.
- B. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.3 MIXING

- A. Open concrete sealer containers only as required for use and mix only in designated areas.
- B. Thoroughly agitate and stir materials to a uniform and smooth consistency suitable for proper installation.
- C. Do not reduce, alter, or introduce foreign materials into concrete sealers, except in conformance with manufacturer’s instructions and other requirements and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification:
 - 1. Verify in-place construction, project conditions, and the work of other specification sections conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Verify substrates are dry and free of curing compounds, sealers, hardeners, and deleterious and other substances that might interfere with paint adhesion, appearance, or performance.
 - 3. Verify items penetrating paint are installed.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 PREPARATION

- A. Protection:
 - 1. Work Area Protection: Protect work areas from dust and other airborne contaminants during surface preparation and paint installation.
 - 2. Adjacent Material Protection: Protect adjacent surfaces against soiling and damage. Utilize drop cloths, shields, masking, barricades, and other items necessary to protect adjacent surfaces.
 - 3. Opening Protection: Close and protect drains and other openings and penetrations to prevent paint intrusion or migration of liquids.
- B. Substrate Preparation: Prepare substrates as required, recommended, or accepted by the manufacturer without limitation; and in a manner that does not result in any warranty or guarantee becoming void.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Install concrete sealers using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Only install concrete sealers under conditions that ensure finishes are free from blemishes and defects.
 - 3. Provide smooth surfaces of uniform finish, color, appearance, and coverage. concrete sealer surfaces with cloudiness, spotting, holidays, runs, or other imperfections are prohibited and are rejected as non-conforming work.
 - 4. Do not exceed the application rates recommended by the manufacturer.

5. Installed concrete sealers must be warrantable. Do not install, correct, or replace concrete sealers in a manner that results in any warranty or guarantee becoming void.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean spills, stains, soiling, overspray, and fallout from adjacent surfaces.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect sealed concrete in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on, adjacent to, or against sealed concrete unless it is protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed sealed concrete surfaces as work surfaces.

END OF SECTION 09 97 23

SECTION 10 14 13 – REGULATORY SIGNAGE

1.1 SUMMARY

- A. Section Includes:
 - 1. Restroom doors signs.
 - 2. Egress stairway door signs.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the sign material manufacturer, unless otherwise indicated.
 - 2. Fabricator: Means the sign fabricator, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
 - 3. Samples: Submit at least 8-inch square representative samples of each sign color, finish, and variety.
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished signs.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.4 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Signs must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).

- a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

B. Regulatory Requirements:

1. Chemical Signs and Labels: Provide Proposition 65 signage in conformance with International Code of Regulations.
2. Raised Characters: Raised characters must conform to the requirements of International Building Code.
3. Depth: It must be 1/32-inch (0.8 mm) minimum above their background and must be sans serif uppercase and be duplicated in Braille.
4. Height: It must be 5/8-inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I". International Building Code.
5. Finish and Contrast: Characters and their background must have a non-glare finish. Character must contrast with their background with either light characters on a dark background or dark characters on a light background. International Building Code.
6. Proportions: It must be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" must be 15 percent maximum of the height of the character. International Building Code.
7. Character Spacing: Spacing between individual raised characters must conform to the requirements of International Building Code.
8. Format: Text must be in a horizontal format. International Building Code.
9. Braille: It must be contracted (Grade 2) and must conform to the requirements of International Building Code. Braille dots must have a domed or rounded shape and must conform to the requirements of International Building Code.
10. Mounting Height: Tactile characters on signs must be located 48 inches minimum to the baseline of the lowest Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. International Building Code.
11. Mounting Location: A tactile sign must be located per International Building Code.
 - a. alongside a single door at the latch side.
 - b. on the inactive leaf at double doors with one active leaf.
 - c. to the right of the right hand door at double doors with two active leaves.
 - d. on the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leaves.
 - e. so that a clear floor space of 18 inches by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
12. Visual characters must conform to the requirements of International Building Code. and must be 40 inches minimum above finish floor or ground.
13. Pictograms must conform to the requirements of International Building Code.
14. Symbols of accessibility must conform to the requirements of International Building Code.
15. Variable message signs must conform to the requirements of International Building Code.

1.5 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage. Avoid damage to packaging and containers, and contamination of contents.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective signs with undamaged new signs that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 PHOTOPOLYMER PANEL SIGNS

- A. Description: Single-piece photopolymer panel permanent identification signs consisting of moisture resistant non-glare photopolymer bonded to sign base material.
- B. Manufacturer: Provide photopolymer products manufactured by Nova Polymers, Inc., or equal.
- C. Fabricators: Provide signs fabricated by one of the following, or equal.
 - 1. Neiman & Co.
 - 2. Signtech Inc.
- D. Materials:
 - 1. Photopolymer Layer: 0.040-inch acrylic photopolymer.
 - 2. Base Material:
 - a. Interior Locations: 0.120-inch phenolic base.
 - b. Exterior Locations: Exterior grade photopolymer applied to a 0.120-inch phenolic base.
- E. Requisite Properties:
 - 1. Overall Panel Thickness: Between 1/8- and 1/4-inch.
 - 2. Colors: ProductOptions indicated on the Drawings or selected by the Architect.
 - 3. Finish: Furnish non-glare finish.
 - 4. Edge Condition: Square cut.
 - 5. Corner Condition: Square.
 - 6. Mounting: Indicated on the Drawings.

7. Copy: ProductOptions indicated on the Drawings or selected by the Architect.
 - a. Letter spacing must conform to standards shown and kerned optically to the acceptance of the Architect.
 - b. Lines of copy must be straight and parallel to the sign format, unless otherwise indicated.
 - c. Edges of letters, numbers, and symbols must be smooth and continuous, with straight and curved portions reproducing the original forms exactly, with corners sharp and true.
 - d. All forms must be free from ticks, line waiver, discontinuous curves, and other imperfections.
8. Font: ProductOptions indicated on the Drawings or selected by the Architect.

2.2 INSTALLATION MATERIALS

- A. Fasteners: Non-removable mechanical fasteners and anchors suitable for secure attachment to substrate and placed through predrilled holes as recommended in writing by the sign manufacturer.
 1. Exposed Fasteners: Exposed fasteners are permitted only where specifically stated in the drawings and must be stainless steel painted or finished to match adjacent surfaces, unless otherwise indicated.
 2. Concealed Fasteners: Fabricate from metals that are not corrosive to the sign material and mounting surface.
- B. Tape: “VHB Tape” manufactured by 3M, or equal.
- C. Adhesive: “732 Multi-Purpose Sealant Clear” manufactured by Dow Corning Corp., or equal.

2.3 ACCESSORIES

- A. Plastic Cement: “WELD-ON 4” manufactured by IPC Corp., or equal.
- B. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer’s requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.

- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install signs using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed signs must be warrantable. Do not install, correct, or replace signs in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach signs to supporting construction.
- C. Installation Tolerances: Install signs to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean all visible sign surfaces in a manner that does not result in any warranty or guarantee becoming void.

1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed signs in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on or adjacent to or against installed signs unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed signs as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 10 14 13

SECTION 10 14 19 – DIMENSIONAL LETTER SIGNAGE

1.1 SUMMARY

- A. Section Includes:
 - 1. Dimensional characters used for building signage.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the signage fabricator, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Shop Drawings: Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project.
 - 2. Samples: Submit at least 8-inch square representative samples of each signage material, finish, and variety.

1.4 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage. Avoid damage to packaging and containers, and contamination of contents.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective signs with undamaged new signs that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Description: Provide cutout characters with square-cut, smooth, eased edges.
- B. Requisite Properties:
 - 1. Material: Indicated on the Drawings or selected by the Architect.
 - 2. Typeface: Indicated on the Drawings.
 - 3. Thickness: At least 1/4-inch thick.
 - 4. Height and Depth: Indicated on the Drawings.
 - 5. Aluminum Finish: Furnish non-glare finish.
 - 6. Mounting: Projected with concealed non-corroding studs for substrates encountered.
 - 7. Spacing and Text/Message: Indicated on the Drawings.

2.2 MATERIALS

- A. Aluminum Plate: ASTM B 209. Provide flat plate stock or extruded material Rolled stock is prohibited. Furnish alloy and temper 5005-H32 for anodic finishing; 3003-H14 for painted or unfinished material.

2.3 FINISHES

- A. Comply with National Association of Architectural Metal Manufacturers publication AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.

- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 2. Installed signage must be warrantable. Do not install, correct, or replace signage in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach signage to supporting construction.
- C. Installation Tolerances: Install signage to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean all visible signage in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.

2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed signage in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on or adjacent to or against installed signage unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed signage as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 10 14 19

SECTION 10 21 13 – TOILET COMPARTMENTS

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic laminate faced toilet compartments.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the toilet compartment manufacturer, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing toilet compartment layout, materials, construction, and finishes. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans and elevations.
 - 3. Samples: Submit at least 8-inch square representative samples of each toilet compartment color, finish, and variety.
- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished toilet compartments.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.
- C. Closeout Submittals: Submit copies of manufacturer's instructions and other requirements and recommendations for toilet compartment maintenance, cleaning, and repair to the Architect as a condition of project closeout.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Toilet compartments must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.

B. Regulatory Requirements:

1. Wheelchair accessible compartments must conform to the requirements of International Building Code.
2. Toe clearance for at least one side partition of a wheelchair accessible compartment must conform to the requirements of International Building Code. It must be 9 inches high minimum above the finish floor and 6 inches deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It must be 12 inches high minimum above the finish floor for children's use. Partition components at toe clearances must be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
3. Ambulatory accessible compartments must be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more fixtures. Such compartments must be provided in the same quantity as wheelchair accessible compartments per International Building Code. and must conform to the requirements of International Building Code.
4. Door and door hardware for accessible compartments must be self-closing and must conform to the requirements of International Building Code except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction must be 44 inches minimum. International Building Code.
5. A door pull complying with International Building Code. must be placed on both sides of the accessible compartment door near the latch.
6. Toilet compartment doors must not swing into the clear floor space or clearance required for any fixture or into the minimum compartment area required for ambulatory accessible compartments.

1.5 HANDLING

A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.

1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
3. Unload and store only inspected and accepted items.

B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.

- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage. Avoid damage to packaging and containers, and contamination of contents.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective signs with undamaged new signs that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE FACED TOILET COMPARTMENTS

- A. Product: Indicated on the Drawings, Sheet A-066, or equal.

2.2 HARDWARE

- A. General:
 - 1. Provide stainless steel 18-8, Type 304 No. 4 finish hardware. Chrome-plated brass, chrome-plated zinc alloy and aluminum hardware are prohibited.
 - 2. Provide manufacturer's standard vandal-resistant option for all hardware.
- B. Hinges: Provide stainless steel wraparound gravity hinges, through-bolted to pilasters, and that allow for fully-adjustable door closing position.
- C. Latches: Provide stainless steel surface-mounted slide latch and keeper.
- D. Door Pull: Provide stainless steel pulls at out-swinging doors mounted in conformance with the accessibility requirements of the authorities having jurisdiction. Provide pulls at both sides of compartment doors indicated to be accessible.
- E. Coat Hook/Bumper: Provide manufacturer's standard combination hook and rubber- tipped bumper, mounted on the water closet side of each compartment door, and sized to prevent door from hitting compartment-mounted accessories.

2.3 ACCESSORIES

- A. Heat-Sink Strips: Provide aluminum heat-sink strips fastened to exposed bottom edges of doors and panels with vandal-proof fasteners.
- B. Brackets: Provide stainless steel continuous brackets.
- C. Pilaster Shoes: Provide 3-inch high stainless steel shoes secured by concealed fasteners.
- D. Mounting Brackets: Stainless steel, mounted inside compartment. Mounting brackets exposed on the exterior of the compartment are prohibited. Wall mounted urinal screen brackets must be at least 0.1250-inch thick (USSG 11) double thickness.

- E. Fasteners: Provide tamper-resistant stainless steel fasteners for component connections, for attaching exposed hardware and for fastening compartments to walls.
- F. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.
- G. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install toilet compartments using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Installed toilet compartments must be warrantable. Do not install, correct, or replace toilet compartments in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Set pilasters with anchorages having at least 2-inch penetration into structural floor, unless otherwise recommended by partition manufacturer.
 - a. Level, plumb, and tighten installation with devices furnished.

- b. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.
- 2. Install hardware as recommended by manufacturer. Conceal evidence of drilling in finished work.
- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach toilet compartments to supporting construction.
- D. Installation Tolerances: Install toilet compartments to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 ADJUSTING

- A. Verify smooth and quiet toilet compartment door and hardware operation.
- B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- C. Replace items that do not operate freely in a safe and reliable manner.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 - 1. written descriptions of non-conforming, damaged, and defective work;
 - 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 - 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible toilet compartment surfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.

2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed toilet compartments in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on or adjacent to or against installed toilet compartments unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed toilet compartments as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 10 21 13

SECTION 10 28 13 – COMMERCIAL TOILET ACCESSORIES

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial toilet accessories.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 SECTION REQUIREMENTS

- A. Submittals: Submit product data and shop drawings.

PART 2 - PRODUCTS

2.1 COMMERCIAL TOILET ACCESSORIES

- A. Coat Hook with Bumper:
 - 1. Products: “B-212” manufactured by Bobrick Washroom Equipment, Inc., or equal.
- B. Surface Mounted Seat Cover Dispenser:
 - 1. Products: “B-221” manufactured by Bobrick Washroom Equipment, Inc., or equal.
 - a. Width: 3/4 inches.
 - b. Height: 11 inches.
 - c. Depth: 2 inches.
 - d. Finish: Stainless steel.
- C. Surface Mounted Jumbo Toilet Tissue Dispenser:
 - 1. Products: “B-2890” manufactured by Bobrick Washroom Equipment, Inc., or equal.
 - a. Width: 10-21/32 inches.
 - b. Height: 10-5/8 inches.
 - c. Depth: 4-1/2 inches.
 - d. Finish: Stainless steel.
- D. Fino Collection Surface Mounted Automatic Hand Dryer ADA Compliant:
 - 1. Products: “B-7179” manufactured by Bobrick Washroom Equipment, Inc., or equal.
 - a. Width: 11-11/16 inches.
 - b. Height: 13-7/16 inches.
 - c. Depth: 3-15/16 inches.
 - d. Finish: Satin finish.
- E. Grab Bars with Snap Flange:
 - 1. Products: “B-5806” manufactured by Bobrick Washroom Equipment, Inc., or equal.

2.2 ACCESSORIES

- A. Pipe Guards:
 - 1. Description: Insulating antimicrobial, molded plastic, white pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Manufacturers: Provide products manufactured by one of the following or approved equal.
 - a. Plumberex Specialty Products, Inc.
 - b. IPS Corp.
- B. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. General:
 - 1. Ensure proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
 - 2. Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed toilet accessories and adjacent items.
 - 3. Install toilet accessories using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 4. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction.
 - 5. Securely attach toilet accessories in place to supporting construction.
 - 6. Installed toilet accessories must be warrantable. Do not install, correct, or replace toilet accessories in a manner that results in any warranty or guarantee becoming void.
- B. Installation Tolerances: Install toilet accessories to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch and from plumb, level, and alignment.
- C. Correction and Repair:
 - 1. Correct deficiencies that do not conform to the Contract Documents.
 - 2. Repair non-conforming, damaged and defective work.
 - 3. Replace soiled items that cannot be cleaned to the same condition as new.
- D. Protection:
 - 1. Protect installed toilet accessories in place from soiling, deterioration, and damage until Substantial Completion.
 - 2. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 10 28 13

SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the fire protection specialty manufacturer, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate size of fire extinguisher cabinets to ensure specified fire extinguishers and capacities are accommodated.
 - 2. Coordinate sizes and locations of fire extinguisher cabinets with wall depths.
 - 3. Final location of fire extinguisher cabinets is subject to fire marshal approval.
 - a. Verify cabinet locations with both the fire marshal and the Architect during the framing stage of the project.
 - b. Positioning of cabinets at locations other than where indicated are at no additional cost to the Owner.
 - 4. Where extinguishers are not indicated, assume cabinets and extinguishers are located within 75 feet of any point in the building, or at a rate of one for each 3,000 square feet of building area, or portion thereof, whichever yields the greater number of fire extinguishers.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data: Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - 2. Shop Drawings:
 - a. Submit dimensioned plans and elevations drawn to scale and showing fire extinguisher cabinet locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference details to plans and elevations.

- B. Informational Submittals: Submit manufacturer's instructions for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
 - 1. Submit manufacturer-prepared published instructions for proper installation of furnished fire protection specialties.
 - 2. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead.
 - 3. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Fire protection specialties must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 - 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in-service conditions applicable to the project.
- B. Regulatory Requirements:
 - 1. Fire Extinguisher Standard: Fire extinguishers must conform to the requirements of International Code of Regulations.
 - 2. Mounting Height: When installed within the cabinet, bracket-mounted extinguisher handles height must conform to the prescribed limits for an ADA-accessible front-approach reach.
 - 3. UL Listing:
 - a. Provide UL-listed fire extinguishers bearing the UL listing mark for type, fire classification, and rating specified.
 - b. Provide cabinets with the same fire rating as wall in which they are installed.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 - 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 - 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 - 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.

- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that that prevents damage. Avoid damage to packaging and containers, and contamination of contents.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective signs with undamaged new signs that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURES

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 - 1. Activar Construction Products Group, Inc.
 - 2. Larsen's Manufacturing Co.
 - 3. Potter Roemer Fire Protection Equipment.

2.2 FIRE ACCESSORIES

- A. Description: UL-listed, heavy duty, enameled steel cylinder, multi-purpose dry chemical fire extinguishers conforming to NFPA 10 requirements for portable extinguishers, and bearing the UL listing mark for type, fire classification, and rating specified.
- B. Products: "JL Industries Cosmic 10E" manufactured by Activar Construction Products Group, Inc., or equal.
- C. Requisite Properties:
 - 1. Capacity: 10 pounds.
 - 2. UL Rating: 4-A:80-B:C.
 - 3. Cylinder Diameter: Not more than 5-1/4 inches.
 - 4. Overall Height: Not more than 22 inches.
- D. Pipe Guards:
 - 1. Description: Insulating antimicrobial, molded plastic, white pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Manufacturers: Provide products manufactured by one of the following, or equal.
 - a. Plumberex Specialty Products, Inc.
 - b. IPS Corp.

2.3 FIRE EXTINGUISHER CABINETS

- A. Description: Fire extinguisher cabinets conforming to ASTM E 814 when installed within fire-resistance rated wall assemblies. Cabinets must have the same fire-resistance rating as the wall in which they are installed.

- B. Stainless Steel Cabinets:
 - 1. Products: “JL Industries Cosmopolitan Series” manufactured by Activar Construction Products Group, Inc., or equal.
 - a. Flat Trim Recessed Cabinets: “Model No. 1035V17” (non-locking) or “Model No. 1035W17” (locking).
 - b. Square Trim Semi-Recessed Cabinets: “Model No. 1036V17” (non-locking) or “Model No. 8136W17” (locking).
 - c. Surface-Mounted Square Cabinets: “Model No. 1033V17” (non-locking) or “Model No. 1033W17” (locking).
 - d. Fire-Rated Cabinets: Provide model numbers with the “-FX2” suffix for fire rated tub option at fire-resistance rated construction.
 - 2. Requisite Properties:
 - a. Door Style: “Vertical Duo” with tempered safety glass.
 - b. Tub Size: 10-1/2 inches wide by 24 inches high by 6 inches deep.
 - c. Frame Size: 13-5/8 inches wide by 27-1/8 inches.
 - d. Non-Rated Cabinet Rough Opening Size: 11-1/2 inches wide by 25 inches high by 6-1/8 inches deep.
 - e. Fire-Rated Cabinet Rough Opening Size: 12-13/16 inches wide by 26-5/16 inches high by 6-11/16 inches deep.
 - f. Finish: Stainless steel No. 6 (satin) finish.
 - g. Door Hardware: Standard pull handle with “Saf-T-Lok”, or equal where indicated as locked.
- C. Accessories:
 - 1. Mounting Brackets:
 - a. Provide manufacturer's standard brackets sized as required for specified extinguishers; manufacturer's standard finish.
 - b. Provide brackets for all extinguishers, including those mounted in cabinets. Provide manufacturer's standard J-hook wall brackets for extinguishers installed within fire extinguisher cabinets.
 - 2. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:

1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 1. Install fire protection specialties using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer- recommended accessories and techniques.
 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 3. Installed fire protection specialties must be warrantable. Do not install, correct, or replace fire protection specialties in a manner that results in any warranty or guarantee becoming void.
- B. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach fire protection specialties to supporting construction.
- C. Installation Tolerances: Install fire protection specialties to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 ADJUSTING

- A. Verify smooth and quiet fire extinguisher cabinet door and hardware operation.
- B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding.
- C. Replace items that do not operate freely in a safe and reliable manner.

3.4 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.

- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.5 CLEANING

- A. Cleaning Work: Clean all visible fire extinguisher cabinetsurfaces in a manner that does not result in any warranty or guarantee becoming void.
 - 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 - 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 - 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 - 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.6 PROTECTION

- A. Protect installed fire protection specialties in place from soiling, deterioration, and damage until Substantial Completion.
- B. Do not store anything on or adjacent to or against installed fire protection specialties unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed fire protection specialties as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 10 44 00

SECTION 12 36 64 – QUARTZ AGGLOMERATE COUNTERTOPS

1.1 SUMMARY

- A. Section Includes:
 - 1. Quartz agglomerate countertops.
 - 2. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications.

1.2 REFERENCES

- A. Definitions:
 - 1. Manufacturer: Means the countertop manufacturer, unless otherwise indicated.
 - 2. Fabricator: Means the countertop fabricator, unless otherwise indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Schedule countertop deliveries to the project site only after the building is enclosed with a permanent enclosure; “wet work” within storage areas (including concrete, cast underlayment, mortaring, grouting, plastering, and gypsum board finishing) is complete and cured or dried to a condition of equilibrium; storage areas are broom- and vacuum-clean; and the HVAC system is activated, operating, and maintaining ambient conditions at occupancy levels.
 - 2. Install countertops only after all other finishing operations are complete, especially overhead finishes.
 - 3. After countertop installation, maintain ambient conditions within design range until Final Completion.
- B. Scheduling:
 - 1. Acclimation: Allow sufficient time in the construction schedule to acclimate countertops to specified ambient conditions for between 72 hours and 6 weeks before installation begins, or until moisture content is not more than 8 percent, when measured with a moisture meter at specified ambient conditions.
 - 2. hever yields the greater number of fire extinguishers.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following for responsive action (formal review and approval).
 - 1. Product Data:
 - a. Submit manufacturer’s product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs), and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action.
 - b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period

- start dates. (e.g., date of manufacture, purchase, installation, Beneficial Occupancy, Substantial Completion, Final Completion, etc.)
2. Shop Drawings:
 - a. Submit dimensioned plans drawn to scale and showing countertop layout and types. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name.
 - b. Include project-specific dimensioned details drawn to scale showing profiles, shapes, joints, seams, and dimensions, including coves, miters, and corner conditions. Cross-reference details to plans.
 - c. Indicate method of attaching, fastening, joining, adhering, and anchoring to adjacent construction.
- B. Informational Submittals: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements).
- C. Closeout Submittals:
1. Maintenance Data: Submit copies of manufacturer's instructions and other requirements and recommendations for countertop maintenance, cleaning, and repair to the Architect as a condition of project closeout.
 2. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Countertops must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation).
 - a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations.
 - b. Items provided for each different installation must be obtained from the same source and manufacturer.
 2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in- service conditions applicable to the project.
- B. Quality Standards:
1. Fabrication Standard: Provide countertops conforming to Architectural Woodwork Institute/ Architectural Woodwork Manufacturer's Association of Canada/ Woodwork Institute publication "Architectural Woodwork Standards" requirements for each specified Grade.
- C. Qualifications:
1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing countertop material installed on at least 200 previous projects similar to this project in size, material, design, and complexity.
 2. Fabricator: Company or individuals must have at least 10 years' experience fabricating countertops installed on at least 100 previous projects similar to this project in size, material, design, and complexity

3. Installer: Company or individuals must have at least 5 years' experience installing countertops for at least 30 previous projects similar to this project in size, material, design, and complexity.
4. Supervisors: Individuals must have at least 7 years' experience installing countertops for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading countertop installers.

1.6 HANDLING

- A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items.
 1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers.
 2. Reject items that are not transported, delivered, or protected in conformance with manufacturer-recommended transport, delivery, and receiving requirements.
 3. Unload and store only inspected and accepted items.
- B. Storage: Store unloaded items indoors as shipped, upright in their original packaging or containers, within dry, well-ventilated, broom-cleaned and enclosed storage areas.
 1. Furnish adequate dunnage and bracing during storage.
 2. Prevent stored items from contacting the floor, from soiling and staining, and from deterioration and damage.
 3. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to heat or sudden changes in temperature or relative humidity; or other sources of deterioration and damage, including dust and other airborne contaminants.
- C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage. Avoid damage to packaging and containers, and contamination of contents.
- D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective signs with undamaged new signs that do not exhibit deterioration, damage, or defects.
- E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site.

1.7 WARRANTY

- A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products and accessories against all patent and latent defects, and incipient and catastrophic failure for 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURES

- A. Manufacturers: Provide products manufactured by one of the following, or equal.
 1. Caesarstone.

2. E. I. du Pont de Nemours and Company (DuPont).

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

- A. Products: “Classico” manufactured by Caesarstone, or equal.
- B. Requisite Properties: Product options indicated on the Drawings or selected by the Architect.
 1. Thickness:
 2. Edge Profile:
 3. Color and Finish

2.3 ACCESSORIES

- A. Construction Adhesive:
 1. Description: General purpose, indoor or outdoor, drillable, moisture resistant, sandable, heavy duty construction adhesive.
 2. Product: “Titebond PROvantage” manufactured by Franklin International, or equal.
- B. Mounting Spacers: Supplied, required, recommended, or accepted by the adhesive manufacturer, if required.
- C. Sealant:
 1. Description: Clear, medium or high modulus, mildew-resistant silicone sealant conforming to ASTM C 920 requirements for Type S, Grade NS, Class 25, Use NT, A or O sealant, as applicable.
 2. Products: Provide “786” manufactured by Dow Corning Corp., or “Sanitary SCS 1700” manufactured by Momentive Performance Materials, Inc., or equal.
- D. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the fabricator for actual in-service conditions applicable to the project.
- E. Cleaner: Supplied, required, recommended, or accepted by the manufacturer for use on installed countertops and actual in-service conditions applicable to the project. Cleaners must remove stains, dirt, and residue without damaging or altering countertop surfaces.
- F. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project.

2.4 FABRICATION

- A. Shop-fabricate countertops to sizes and shapes indicated on the Drawings and in largest sections practicable to minimize field jointing.
- B. Fabricate exposed work precise, straight, and true to line, size, and shape; square and within allowable tolerances; and with accurate angles and surfaces, and crisp straight edges.

- C. Cut, drill, and punch countertops as required to receive other components, accessories, hardware, and similar items, and as required to securely attach to supporting construction. Provide openings and similar features as needed to accommodate adjacent work.
- D. Carefully inspect finished units at the shop for conformance to specified requirements for appearance, material, and fabrication. Replace defective units.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation.
- B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items.
- C. Evaluation and Assessment:
 - 1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations.
 - 2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install countertops using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques.
 - 2. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
 - 3. Perform drilling and fitting as required or necessary for an accurate fit and complete installation.
 - 4. Installed countertops must be warrantable. Do not install, correct, or replace countertops in a manner that results in any warranty or guarantee becoming void.
- B. Special Techniques:
 - 1. Shim as required using concealed shims.
 - 2. Scribe and fit accurately against adjacent surfaces for a close fit.
 - 3. Attach countertops securely to supports with concealed screws as required for a rigid and secure installation.
 - 4. Seal interface of countertops with contiguous surfaces with sealant.

- C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach countertops to supporting construction.
- D. Installation Tolerances: Install countertops to an allowable tolerance variation of not more than 1/4-inch from true position and not more than 1/8-inch from plumb, level, and alignment.

3.3 CORRECTION AND REPAIR

- A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs without reimbursement from Owner, until accepted in writing by the Architect.
- B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include
 1. written descriptions of non-conforming, damaged, and defective work;
 2. supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work; and
 3. similar written descriptions and visual depictions of Contractor-proposed corrections and repairs.
- C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance.

3.4 CLEANING

- A. Cleaning Work: Clean all visible surfaces in a manner that does not result any warranty or guarantee becoming void.
 1. Use cleaning materials, equipment, and accessories supplied, and means, methods, techniques, and procedures required, recommended, or accepted by the manufacturer.
 2. Do not use cleaning materials or procedures known to change, or that might change, the appearance of exposed finishes or adjacent surfaces; or cause deterioration or damage to exposed finishes or adjacent surfaces.
 3. Protect adjacent surfaces not being cleaned from staining, deterioration, damage, or other detrimental effects caused by cleaning.
 4. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be cleaned to the Architect's acceptance.
- B. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items.

3.5 PROTECTION

- A. Protect installed countertops in place from deterioration, and damage until Substantial Completion.

- B. Do not store anything on, adjacent to, or against installed countertops unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed countertops as work surfaces.
- C. Remove protection when it's no longer needed and before Substantial Completion.

END OF SECTION 12 36 64

SECTION 22 05 01 – PLUMBING GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions and Division 1 are a part of the requirements for the work under this Division of the Specification.

1.2 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the heating, ventilating, air conditioning systems as called for in the Contract Documents and according to applicable codes and regulations.
- B. Provide labor, materials and accessories required to provide complete operating plumbing systems as described or which may be reasonably implied as essential for a complete operating system.

1.3 QUALITY ASSURANCE

- A. Comply with current governing codes, ordinances and regulations of the Authority or Authorities Having Jurisdiction over any part of the work and secure all necessary permits. Comply with the regulations and requirements of the Owner's insurance underwriter.
- B. Where codes or standards are referenced, the current edition and applicable portions apply, unless noted otherwise.
- C. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.
- D. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress during the Contractor's working hours. A report will be issued to the Contractor if the field review of the plumbing systems construction has revealed elements of the work, which are inconsistent with the Contract Documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks and corrections in the field shall be made as directed.

1.4 ABBREVIATIONS AND DEFINITIONS

- A. Abbreviations:

1.	ABMA	American Boiler Manufacturers Association
2.	AFBMA	Anti-Friction Bearing Manufacturers Association
3.	AGA	American Gas Association
4.	ANSI	American National Standards Institute
5.	ASA	Acoustical Society of America
6.	ASCE	American Society of Civil Engineers
7.	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
8.	ASME	American Society of Mechanical Engineers
9.	ASTM	American Society for Testing and Materials
10.	AWWA	American Water Works Association
11.	BSI	British Standards Institution
12.	CTI	Cooling Tower Institute
13.	EPA	Environmental Protection Agency
14.	ETL	ETL SEMKO
15.	FM	Factory Mutual

19.	IEEE	Institute of Electrical and Electronic Engineers
16.	ISO	International Organization for Standardization
17.	MSS	Manufacturers Standardization Society
18.	NAAMM	National Association of Architectural Metal Manufacturers
19.	NEBB	National Environmental Balancing Bureau
20.	NEMA	National Electrical Manufacturers Association
21.	NFPA	National Fire Protection Association
22.	NIOSH	National Institute for Occupational Safety and Health
23.	NSF	National Sanitation Foundation
24.	OSHA	Occupational Safety and Health Administration
25.	UL	Underwriters Laboratories Inc.
26.	ULC	Underwriters Laboratories of Canada

B. Definitions:

1. Where it is stated in the specifications to submit to Architect or Engineer for review, refer to Architectural General and Special Conditions for proper procedures.
2. “PROVIDE” means to “Furnish” and “Install”. “INSTALL” means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
3. “FURNISH” means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.
4. “AS DIRECTED” means as directed by the Architect, or the Architect’s Representative.
5. “SUBMIT” means submit to the Architect for review.

1.5 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with Contract Documents. Guarantee work against faulty and improper material, fabrication, installation, start-up and commissioning for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, at no additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

1.6 USE OF THE ARCHITECT’S AND ENGINEER’S DRAWINGS

- A. The Contractor shall obtain, at the Contractor’s expense, from the Architect or Engineer a set of digital data files in Autodesk REVIT compatible format architectural and engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Architect and Engineer a written release of liability acceptable to the Architect and Engineer prior to receiving the electronic media files.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.
- B. Products and materials shall not contain asbestos, PCBs or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect.
- D. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.
- E. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.
- F. Install materials and equipment with qualified trades people.
- G. Maintain uniformity of manufacture for equipment used in similar applications and sizes.
- H. Applicable equipment and materials to be listed by Underwriters Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by Authorities Having Jurisdiction. The energy-using products shall be certified for use in the State of California and meet State energy efficient standards.
- I. Fully lubricate equipment when installed.
- J. Do not operate air systems until ductwork is complete, temporary filters are in place and construction debris is removed. Provide 1-inch thick fiberglass filter media across the face of each return air opening prior to start of each air system during temporary system operation and system clean-out.
- K. Install floor-mounted equipment on a minimum 4-inch high concrete pad. Concrete work shall be provided by another trade. Coordinate size and location with actual equipment used and accepted layout shop drawings.
- L. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in concrete under entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.
- M. Locate valves, traps, damper operators, access doors, etc., to be easily accessible, either in plumbing spaces or through access panels specified. Obtain Architect's approval of access panel locations.
- N. Follow manufacturers' recommendations and instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- O. Equipment capabilities, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on shop drawings.

2.2 ALTERNATIVE EQUIPMENT AND MATERIALS

- A. Contract Documents are based on materials specified and on equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the quality and performance as stated or implied in the Contract Documents.
- B. Equipment manufacturers listed in individual sections are acceptable for this project, subject to requirements of Contract Documents.
- C. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed alternative whether alternative is accepted or rejected.
- D. Include revisions required to adapt alternatives in such proposals, including revisions by other trades. No increase in the contract price will be considered to accommodate the use of alternative equipment.
- E. Wherever quality standards (such as serviceability, energy efficiency, longevity or durability) and operating results (such as noise levels, quantity delivered or pressure obtained) are specified or scheduled, or when the manufacturer and size of equipment, for which such operating results are published or determinable, is specified, the substitution being proposed must conform substantially to the quality and quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.
- F. In making a request for a proposal for alternative equipment or materials, the Contractor:

1. Represents that the Contractor has personally examined the Contract Documents and has determined that the proposed substitution is appropriate for the use intended in the Contract Documents and is equal or superior in all aspects to that specified.
 2. Represents that the substitution has received the necessary approvals of the Authorities Having Jurisdiction.
 3. Will coordinate installation of the accepted substitution into the work, making such changes as may be required for the work to be complete in all aspects.
- G. Proposed changes and substitutions of systems, equipment and manufacturers shall be submitted and include the following information with the proposal:
1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to other trades.
 2. Schematic drawings and details to supplement the description.
 3. A list of the contract requirements that must be revised if the change is accepted, including any specification revisions.
 4. Complete list of materials and equipment proposed for use in the change.
 5. Include a description and estimate of costs the Owner may incur in implementing the change, such as additional space requirements, permits, architectural and aesthetic impact, design costs, tests, permits evaluation, operating and support costs.
 6. A projection of any effects the proposed change would have on collateral costs to the Owner.
 7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
 8. A statement indicating the reduction to the contract price if the Owner accepts the change. Be responsible for appropriate modifications to all trades.

PART 3 – EXECUTION

3.1 FEES

- A. Pay all required fees and obtain required permits related to the plumbing installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.
- C. Provide controlled or witnessed inspection where required by Authorities Having Jurisdiction or by these specifications.

3.2 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. After receiving notice to proceed from the Owner or Owner's Representative, or after execution of Owner/Contractor Agreement, submit a complete list of all plumbing equipment manufacturers and material suppliers for the equipment proposed to be provided on this project as well as names of all subcontractors.
- C. After receiving notice to proceed from the Owner or Owner's Representative or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the specification sections or drawing number, and an item description. Prefix the submittal identification number by the specification sections to which they apply. Indicate, on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as

- required to comply with the Contract Documents and the shop drawings.
- E. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments does not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
 - F. No part of the work shall be ordered, procured, started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted, reviewed and returned with either “No Exceptions Noted” or “Exceptions Noted” marked on the submission.
 - G. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Architect/Engineer’s office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.
 - H. Submit all required shop drawings and manufacturer’s product submittals in electronic portable document format (PDF) through a file sharing website or as required by the Owner’s Representative or Architect. Review comments will be marked up electronically in the submittals and returned to the Owner’s Representative or Architect. Hard copy paper submittals will not be accepted. Electronic submittals shall be provided with the following information and format:
 1. Provide each submittal as a complete indexed file incorporating all requirements of the specific submittal section being submitted for review.
 2. Name file with project identifier, submittal number and revision number.
 3. Include the following minimum information as metadata in the electronic PDF file:
 - a. Project Name
 - b. Specification Section Number and Title
 - c. Drawing/Detail Reference Numbers (as appropriate)
 - d. Manufacturer Name
 - e. Product Name
 4. Provide electronic transmittal form with the following information:
 - a. Project Name
 - b. Date Initiated and Date Due
 - c. Contact Details for Owner, Architect and Engineer
 - d. Name of Contractor, Sub-Contractor, Manufacturer and/or Supplier
 - e. Type of Submittal
 - f. Specification Section Number and Title
 - g. Drawing/Detail Reference Numbers (as appropriate)
 - h. Indication of Partial or Full Submittal
 - i. Stamp Page for Submittal Stamps.
 - I. Submissions will be stamped as follows:

Stamp	Interpretation
No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
Exceptions Noted: - Resubmit for Record - No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents and Engineer’s notations are complied with. Within this category are two options. A resubmission for our records is required when corrections are necessary. A resubmission is not required if there are only minor comments.
Revise and Resubmit	The submittal does not comply with the Contract Documents; do not proceed with fabrication, manufacture, or construction.

The work and shop drawings are not permitted at the job site. Resubmit appropriate shop drawings.

- J. Submit materials and equipment by manufacturer, trade name and model number. Include clear, legible copies of applicable brochure or catalog material. Maintenance and operating manuals are not suitable substitutes for shop drawings.
- K. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as voltages, motor efficiencies, special tank linings, pump seals, materials or paint finishes. Cross out all references to "options". Cross out statements such as "subject to change without notice" or "not for construction". Anything not specifically excluded is assumed to be included.
- L. Provide dimensional data for roughing in and installation including required maintenance and service access clearances. Include technical data sufficient to verify that equipment meets requirements of the Contract Documents. Include wiring diagrams showing factory installed and field wiring requirements, piping and service connection data, motor sizes complete with voltage ratings, and schedules.
- M. Maintain a complete set of the most current reviewed and stamped shop drawings and product data on site.
- N. Prepare and submit detailed shop drawings for ductwork, piping work and other distribution services in minimum 1/4-inch to 1-foot scale, including elevations and locations and sizes of openings in floor decks, walls and roofs.
- O. The work described in shop drawing and product data submittals shall be carefully checked by all trades for clearances (including those required for code compliance, maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. Each submitted shop drawing to include a certification that related field conditions and requirements have been checked by all Contractors and Subcontractors and that conflicts do not exist.
- P. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions or for deviations from requirements in the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.
- Q. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.
- R. Indicate the following in the lower right-hand corner of each shop drawing, and on the front cover of each product data brochure: the submittal identification number; title of the sheet or brochure; name and location of the Project; names of the Architect, Engineer, Contractor, Subcontractor, Manufacturer, Supplier, and Vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures, test reports or submittals consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of shop drawings or product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

3.3 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. The Contract Documents show the general arrangement of equipment, ductwork, piping and accessories. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- C. Certain products will be provided by other trades. Examine the Contract Documents to ascertain the requirements for installation of these products.
- D. Carefully check space requirements with other trades to ensure that material can be installed in the

spaces allotted.

- E. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (valves, dampers, coils, etc.) requiring access in order that the ceiling and partition contractors can install access doors and panels in the correct locations.
- F. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.
- G. Furnish and set sleeves for passage of pipes, conduits and conduits through structural masonry and concrete walls, roofs and floors and elsewhere as will be required for the proper protection of each pipe, conduit and duct passing through building surfaces.
- H. Install firestopping around all pipes, conduits, etc., which pass through rated walls, partitions and floors in strict accordance with the manufacturer's published approval listing and rating.
- I. Provide detailed information on openings and holes required in structural elements and pre-cast panels or components for plumbing work.
- J. Provide required structural or architectural supports and hangers for ductwork, piping and equipment, designed so as not to exceed allowable loadings of structures.
- K. Examine and compare the Contract Drawings and Specifications with the drawings and specifications of other trades, report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of record drawings.
- M. Before commencing work, examine adjoining work on which this work is in any way dependent and report conditions that prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- N. Adjust location of pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.
 - 1. Right-of-Way: Lines which pitch have right-of-way over those which do not pitch. For example: condensate and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - 2. Provide offsets, transitions and changes in direction of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required to effect these offsets, transitions and changes in direction.
- O. Install plumbing work to permit removal (without damage to other parts) of heat exchanger, boiler, heat exchanger plates, controls, sheaves and drives, and any other parts requiring periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit access to valves, cocks, traps, starters, motors, and control components, and to clear the openings of swinging doors and access panels.
- P. Provide access panels in equipment, controls, etc., as required for inspection and maintenance of concealed or internal equipment, controls, etc.
- Q. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary instructions from the Architect.

3.4 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as piping, busway, conduit, ductwork, etc., including conduit embedded in concrete floors and walls. The Coordination Drawings shall be submitted complete to the Architect and the Engineer after notice to

proceed is given and in compliance with the construction schedule for the project. Each separate Trade Contractor shall draw their work on separate layers with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and Coordination Drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost to the Owner.

- C. The Contractor's Coordination Drawings shall indicate structural loads at support points for all piping 10-inch and larger, racked piping, racked conduit and busway. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Architect to change them.
- E. Prior to final acceptance of the work, the Contractor shall submit the Coordination Drawings as part of the Record Drawing submittal.

3.5 EXAMINATION OF SITE

- A. The Contract Documents do not make representations regarding the character or extent of the subsoils, water levels, existing structural, plumbing and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.6 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or as required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95 percent of standard proctor density or 75 percent relative density or as specified by the Architect. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
- C. Excavate trenches for utilities that will provide the required minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.
- D. Trenches shall not be placed within ten (10) feet of foundation or soil surfaces that must resist horizontal forces.

- E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive material with limited porosity. Deposit backfill in 6-inch thick layers and tamp carefully until the plumbing work is covered by not less than 12 inches of material. Backfill and tamp remainder of trench at 1-foot intervals until complete. Uniformly grade the finished surface.

3.7 CUTTING AND PATCHING

- A. Where cutting, channeling, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- B. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect.
- C. Where ductwork, piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

3.8 PROHIBITED LABELS AND IDENTIFICATIONS

- A. Prohibited Markings: In all public areas, tenant areas, storage areas and similar locations within the project, the inclusion or installation of any equipment, fixture or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Exception: Required Underwriters Laboratories labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

3.9 EQUIPMENT PAD AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted plumbing equipment. This includes electrical components, equipment mounted on legs and pipe support stands. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 2-inch margin around the equipment and supports. Pads shall be a minimum of 4-inches high and made of a minimum 28-day, 2,500-psi concrete reinforced with 6-inch by 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a ¾-inch radius. Use shop drawings stamped "NO EXCEPTIONS NOTED" or "EXCEPTIONS NOTED" for dimensional guidance in sizing pads.
- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Verify bolts size, number and embed depth recommended by the manufacturer of the equipment with seismic calculations as specified, and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation and seismic restraint manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws will pass through the gypsum board and be securely attached to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6-inch square, 18-gauge galvanized metal backplates that are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

3.10 DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for disassembly, re-assembly,

manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost to the Owner.

3.11 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials and equipment until finally inspected, tested and accepted. Protect work against theft, injury or damage; and carefully store material and equipment received on site that is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, moisture, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry heated spaces.
- C. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.12 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

- A. Do not install piping, equipment or ductwork for heating, ventilation, air conditioning, plumbing or any piping systems not included as part of the electrical work, in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.
- B. Do not install piping, equipment or ductwork above switchboards, disconnects, panelboards, dimmers, control panels, VFDs, motor control centers, individual motor controllers, electronics, etc or the code-required service space for these electrical devices.

3.13 EQUIPMENT GUARDS

- A. Provide removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts of machinery. Provide tachometer openings in the guards at least 2-inches in diameter, for all belt-driven, gear-driven or variable speed machinery. Comply with OSHA requirements for all equipment guards.

3.14 LUBRICATION

- A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.
- B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.15 DATE OF COMPLETION AND TESTING OF PLUMBING SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing and commissioning prior to occupancy and the Contract closeout. Complete any adjustments and/or alterations that the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when tests and commissioning will be performed. Update this schedule periodically as the project progresses.

3.16 TITLE 24 ACCEPTANCE TESTING

- A. The Contractor is to act as the Responsible Person for all acceptance tests required per the California Energy Efficiency Standards, Title 24, Part 6.

- B. The acceptance requirement process must address the following:
- C. Construction Documents Plan Review.
- D. Review the installation, and complete the required acceptance testing.
- E. Certify the acceptance test results on the Certificate of Acceptance.
- F. Submit the Certificate to the Building Department prior to receiving a final occupancy permit.

3.17 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and systems specified and train the Owner's operating and maintenance personnel for a three (3) day operating/instruction period. Operating instruction time is defined as straight time working hours and not including nights, weekends or travel time to and from the project. Refer to individual sections for additional training and instruction by manufacturer's trained specialists.
- B. Notify the Owner in writing at least three (3) weeks before the operating/instruction period begins. Do not commence until the Owner has issued written acceptance of the starting time and schedule.
- C. In addition to the operating/instruction period, organize and conduct a seminar to instruct the Owner's Representatives in the operation and general preventative maintenance of equipment and systems provided at the completion of the project.
- D. Instruct Owner's operating personnel in the basis of design, available project documentation, proper starting sequences, operation, shut-down, and maintenance procedures. Instruction for both normal and emergency operations procedures shall be provided and documented.
- E. Make arrangements to give instructions by system and not by building areas. Organize training session and the video recording to present segments for equipment types, and overall systems following the Table of Contents of the Operating and Maintenance manuals.
- F. Provide services of qualified personnel, including each sub-trade, each major equipment supplier to attend seminar and instruct on respective equipment or systems. Seminar shall be conducted by the Contractor and shall be professionally videotaped with lighting and narration. The seminars may be attended by the Architect or Architect's Representative.
- G. Submit seminar agenda, schedule and list of representatives to the Owner for review thirty (30) days prior to seminar. Confirm attendance at seminar by written notification to participants.
- H. At seminar, submit final copies of record drawings and operating and maintenance manuals to Owner.
- I. Submit a written record of the seminar, complete with an attendance list to the Owner.
Provide two copies of the recorded training video on USB flash drives.

3.18 OPERATING AND MAINTENANCE MANUALS

- A. Provide operating instructions and maintenance manuals for all equipment and materials furnished under this Division. Manuals shall be available at the operations training seminar.
- B. Submit a draft copy of operating and maintenance manuals in PDF format for review at least ten (10) weeks before the completion date. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.
- C. After the Architect's and Engineer's review, and any required Contractor revisions, the operating and maintenance manuals shall be delivered to the Owner as three (3) hard paper copies in a binder as described below and separately on electronic media in PDF format.
- D. Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8.5-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 1. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross referenced to Specification Section number and title of Project Manual.
 - 3. Supplementary Text: Prepared on 8.5-by-11-inch white bond paper.
 - 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

- a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Manual Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system.
- F. Maintenance information shall include complete lubrication, cleaning, and servicing data compiled in clearly and easily understandable format. Show model and serial number of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- G. Provide the following equipment operating and maintenance information where applicable:
 - 1. Identifying equipment manufacturer, product name, model number and number
 - 2. Locations (where several similar items are used, provide a list)
 - 3. Systems and equipment controls including description of the sequence of operations and control diagrams.
 - 4. Performance curves and data
 - 5. Wiring diagrams
 - 6. Lubrication charts
 - 7. Manufacturers' recommended operating and maintenance instructions, with all non-applicable information deleted
 - 8. List of spare parts recommended for normal service requirements
 - 9. Assembly and disassembly instructions with exploded view Drawings, where necessary.
 - 10. Start-up procedures
 - 11. Routine and normal operating instructions
 - 12. Normal and emergency shutdown instructions
 - 13. Trouble shooting diagnostic instructions, where applicable

3.19 RECORD DRAWINGS

- A. The Contractor shall maintain on a daily basis at the project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of prints or AutoCAD REVIT files of the Contractor's Coordination Drawings. The prints shall be marked, or the AutoCAD REVIT files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded piping and valves, and all changes and deviations in the plumbing work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD REVIT electronic format media upon project completion.
- B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two (2) dimensions to permanent structures.
Provide record drawings of the following items as a minimum:
 - 1. Dimensional changes to Drawings.
 - 2. Revisions to details shown on Drawings.
 - 3. Locations and depths of underground utilities.
 - 4. Revisions to routing of piping and conduits.
 - 5. Actual equipment locations.
 - 6. Duct size and routing.
 - 7. Locations of concealed internal utilities.
 - 8. Changes made by Change Order.
 - 9. Field records for concealed conditions.
 - 10. Record information on the Work that is shown only schematically in the contract documents.

- C. The Contractor and subcontractor shall mark all in-progress Record Drawings on the front lower right-hand corner with a rubber stamp impression or an AutoCAD REVIT image similar to the following:

RECORD DRAWING To be used for recording Field Deviations and Dimensional Data Only

- D. Upon completion of the work, the Contractor and subcontractors shall certify all Record Drawings on the front lower right-hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD REVIT image similar to the following:

RECORD DRAWING CERTIFIED CORRECT <u>(Printed Name of General Contractor)</u> Date: _____ <u>(Printed Name of Subcontractor)</u> Date: _____

- E. Prior to final acceptance of the work of this Division, the Contractor shall submit properly certified Record Drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the Record Drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD REVIT format. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.
- F. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. After review, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 4. Architect will provide data file layer information. Record markups in separate layers.

3.20 CERTIFICATION

- A. Any certifications required by the Specifications, in addition to those required for shop drawings, product data, equipment and other items, are to be so certified in writing by the Owner, a Partner, or a Corporate Officer of the firm required to provide the Certification, or by another person duly authorized to sign binding agreements for and on behalf of the Owner, Partner or Corporation.

3.21 FINAL REVIEW

- A. At a time designated by the Owner, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.
- B. Demonstrate to the Owner and/or the Architect's personnel prior to the Final Review that systems and equipment have been properly balanced and adjusted and are in compliance with the requirements of the Contract Documents. After these demonstration tests are satisfactorily completed, but prior to the

Final Review, submit a written certification that attests to the Contract Document compliance for this project

- C. Prior to the final review, the Contractor shall confirm the following items regarding the status of key elements of the work. Negative responses to any of the items indicate that the construction is not substantially complete, and the building is not ready for a final review. The Contractor shall confirm the following in writing:
1. Building air systems (fans, air handling units, etc.) are completely installed, commissioned and operating.
 2. Building refrigerant systems are completely installed, commissioned, operating and pressure tested.
 3. Controls system is installed, commissioned and operating.
 4. Building has normal electrical power.
 5. Building systems have been cleaned.
 6. Seismic restraints have been inspected as specified. Any required special inspections have been completed.
 7. Building systems have been balanced and copy of balance report submitted to the Architect.
 8. Building fire and life safety systems have been tested and accepted by the local authorities. Any required special inspections have been completed.
 9. There are no deviations or non-compliance with the Contract Documents; otherwise, provide a detailed account of any and all deviations or noncompliance.
 10. All items on field review reports have been responded to in writing and are resolved to the satisfaction of the Owner.
 11. All outstanding items on submittals and shop drawings have been addressed in writing and are resolved to the satisfaction of the Owner.
 12. Schedule the final review only after providing written confirmation of all items above. Provide a minimum of ten (10) days' notice.
- D. Operate the entire system properly with all systems balanced and all controls adjusted.
- E. Certificates and Documents required by the Contract shall be presented to the Architect at least two (2) weeks prior to the Final Review.
- F. After the Final Review, any changes or corrections noted as necessary for the work to comply with the Contract Documents shall be accomplished without delay in order to secure final acceptance of the work.

3.22 EARLY OCCUPANCY

- A. Be responsible for completing those systems, which are necessary to allow partial occupancy of the building even if systems in the unoccupied areas are incomplete.
- B. Verify and comply with requirements for temporary occupancy with the local Building Department.

END OF SECTION 22 05 01

SECTION 22 05 29 – SUPPORTS, HANGERS, ANCHORS AND SLEEVES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include, but is not limited to the following:
 - 1. Pipe and un-isolated equipment hangers, anchors and supports.
 - 2. Sleeves, escutcheons.
 - 3. Through-penetration firestopping in fire-rated construction and through penetration Smoke stopping in smoke partitions, including methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

1.2 RELATED DOCUMENTS

- A. Section 22 05 01 – Plumbing General Provisions
- B. Section 22 05 48 – Vibration and Seismic Restraints
- C. Section 22 07 00 – Insulation
- D. Section 22 11 10 – Piping and Accessories.

1.3 REFERENCE STANDARDS

- A. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc.:
 - 1. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacturer
 - 2. MSS SP-69 Pipe Hangers and Supports - Selection and Application
- B. Underwriters Laboratories:
 - 1. UL Fire Resistance Directory
 - 2. UL 1479 Test Method for Fire Tests of Through-Penetration Firestops
 - 3. UL Component Listing Test Criteria
- C. American Society for Testing and Materials Standards: ASTM E 814 - 88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 SUBMITTALS

- A. Include on piping shop drawings a layout of masonry and concrete floor and wall sleeve locations for pipes. Include elevations and sleeve sizes.
- B. Submit product data on through-penetration firestop. Submittal data for firestopping systems shall include the UL System Numbers listed in the UL Building Materials Directory under which the material was tested in accordance with ASTM E 814 (UL 1479) for use in a Through-Penetration Firestop System. Where there is a firestop application that has not been tested by UL, obtain from the manufacturer an engineered judgment that the proposed application of the firestop product is suitable. Submit the engineered judgment to the authority having jurisdiction.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe Hangers:
 - 1. Anvil
 - 2. Fee & Mason
 - 3. Elcen,
 - 4. F&S
 - 5. Pipe Shields

6. Michigan Hanger
 7. Power Strut
 8. Unistrut,
 9. Or approved equal
- B. Sleeves:
1. Pipe Shields
 2. RK Industries
 3. Or approved equal
- C. Pipe Wrap Tape:
1. Polycen
 2. Nassua
 3. 3M
 4. Or approved equal
- D. Firestop:
1. Nelson
 2. Dow
 3. 3M
 4. Hilti
 5. Or approved equal
- E. Escutcheon Plates:
1. Beaton & Corbin Manufacturing
 2. Or approved equal
- F. Mechanical Sleeve Seals:
1. Pipeline Seal and Insulato
 2. Thunderline Linkseal
 3. Calpico Pipe Linx
 4. Metraflex Metraseal
 5. Or approved equal

2.2 GENERAL

- A. Provide hangers of heavy construction suitable for the size of pipe to be supported. Materials shall be of steel, except pipe rolls of wrought or malleable iron.
1. Hangers for pipes eight-inches or less shall be swivel ring, wrought pipe clamp, or adjustable wrought clevis type. Anvil Figure 260, MSS-SP-69, Type 1.
 2. Hangers for ductile iron or cast-iron pipes four-inches or less shall be swivel ring, wrought pipe clamp or adjustable wrought clevis type. Anvil Figure 590, MSSSP-69, Type 1.
 3. Hangers for pipes ten-inches and above shall have two rods and cross-rod with cast iron pipe roll complete with adjustable sockets and nuts. Anvil Figure 177, MSS-SP-69, Type 41.
 4. When an oversized clevis type hanger is used (i.e., insulate pipe) a pipe spacer shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt.
- B. Multiple or trapeze pipe hangers shall be steel channels with welded spacers and hanger rods if hanger load calculations are submitted.
- C. Wall support shall be welded steel bracket with hanger:

Light Duty Wall Support:	Anvil Figure 194, MSS-SP-69, Type 31.
Medium Duty Wall Support:	Anvil Figure 195, MSS-SP-69, Type 32.
Heavy Duty Wall Support:	Anvil Figure 199, MSS-SP-69, Type 33.

- D. Support vertical piping with carbon steel double bolt riser clamps attached to the pipe. In general, use one clamp for each two floors and one clamp at each floor for copper tubing. Where pipes are in open shafts, provide forged steel bar brackets fixed to wall. Riser clamps shall be copper plated when used with copper pipe. Anvil Figure 261 for steel pipe, Anvil Figure CT121 for copper pipe.

- E. Floor Support for Pipe:
 - 1. Sizes up to 4 inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support. Anvil Figure 264, MSS-SP-69, Type 38.
 - 2. Sizes 5 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support. Anvil Figure 265, MSS-SP-69, Type 38.
 - 3. Provide pipe stanchions for support of pipe elbows at base of riser and vertical piping. Stanchions shall be complete with base plate and vent hole. Anvil Figures 62 and 63.
- F. Select hangers and supports in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- G. Hangers shall not be disengaged by movement of supported pipe.
- H. Provide copper-plated or felt-lined hangers for copper piping or provide 10-mil pipe wrap tape on pipe at hangers. Tape shall extend a minimum of 2 inches beyond hanger saddle on both ends and be wrapped around pipe a minimum of 2 turns. Install vinyl coated hangers for all plastic piping.
- I. Steel hanger rods shall be threaded both ends, threaded one end, or continuous threaded, black finish. Provide rods complete with adjusting and lock nuts. Anvil Figures 146, 140 or 253.
- J. Pipe Support Recommendations for Rigid Grooved Joint Systems: The maximum hanger spacing in the specification to ANSI/ASME B31.1 as noted and should be used only in conjunction with Victaulic 07 zero-flex rigid couplings. For flexible systems the hanger, support, spacing and location refer to the pipe support recommendations section in the Victaulic "Field Assembly and Installation Pocket Handbook" or equivalent provided by Grooved Joint Manufacturer.
- K. Beam Clamps:
 - 1. Provide MSS-SP-69 Type 23 malleable black iron clamp for attachment to beam flange up to 0.62 inches thick for single threaded rods of $\frac{3}{8}$ -, $\frac{1}{2}$ -, and $\frac{5}{8}$ -inch diameter, for use with pipe sizes 4-inch and less. Furnish with a hardened steel cup point set screw. Anvil Figure 86.
 - 2. Provide MSS-SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes up to 1.5-inch diameter but limited in application to pipe sizes 8-inch and less without prior approval. Anvil Figure 228.
- L. Continuous Concrete Insert Channels:
 - 1. Provide steel inserts with industry standard pre-galvanized finish, nominally $1\frac{5}{8}$ -inch wide by $1\frac{3}{8}$ -inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices.
 - 2. Installed channels shall provide a load rating of 2,000 pounds per foot in concrete. Manufacturer's standard brackets, inserts, and accessories designed for use with continuous concrete inserts are acceptable.
 - 3. Select insert length to accommodate all pipe, duct, and conduit in the area.
- M. Anchors shall be fabricated using welding steel shapes, plates, and bars to secure piping to the structure.
- N. Concrete inserts shall be MSS-SP-69 Type 18 wedge type or universal concrete inserts.
 - 1. Wedge type shall be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to $\frac{7}{8}$ -inch diameter. Wedge design shall allow the insert to be held by concrete in compression to maximize the load carrying capacity. Anvil Figure 281.
 - 2. Universal type shall be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to $\frac{7}{8}$ -inch diameter. Anvil Figure 282.
 - 3. Use drilled steel shell with plug type inserts when the inserts are placed after the concrete is poured.
- O. Drainage Piping: Provide MSS-SP-69 Type 8 or MSS-SP-69 Type 42 riser clamps for vertical piping, and MSS-SP-69 Type 52, spring hangers at the base of vertical piping.

2.3 SLEEVES

- A. Construct sleeves for pipes passing through walls (other than foundation walls), floors, partitions, hung or furred ceilings, etc., of minimum 18-gauge galvanized steel, flanged on each side of wall, partition, hung or furred ceiling, etc.
- B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.
- C. Provide 20-gauge galvanized sheet metal sleeves, the full depth of floor or wall, for round ductwork

passing through masonry or concrete and/or steel cellular floor construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.

- D. Provide cast iron or fabricated “wall pipe” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Stack Sleeve Fittings: Provide manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing and underdeck clamping ring with setscrews.
- F. Provide mechanical sleeve seals at exterior wall and tank wall penetrations. Seal shall be of the modular sealing element unit type, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: [EPDM] [Nitrile] [Silicone] interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: [Plastic] [Carbon steel with corrosion-resistant coating]. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: [Carbon steel with corrosion-resistant coating] [Stainless steel] of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- G. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations. Provide manufactured wall and ceiling escutcheons and floor plates, with an inside diameter to closely fit around pipe, tube, and insulation of insulated piping and an outside diameter that completely covers opening. Escutcheons shall be cast iron or cast brass, deep-pattern escutcheons if required to conceal protruding fittings, sleeve hubs or firestopping projections.

2.4 PENETRATION FIRESTOP

- A. Fire-Rated Construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, and sound or vibration absorption, and at other construction gaps.
- B. Smoke Barrier Construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.
- C. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free. Mortar systems must be Warnock Hersey approved.
- D. Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.
- E. All firestopping products must be from a single manufacturer.
- F. Through-penetration smoke-stopping at smoke partitions: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded in a non-fire rated smoke barrier.
- G. Seal all pipe and duct penetrations through fire-rated construction with factory-built devices or with manufactured fill, void, or cavity materials “Classified” by Underwriters Laboratories Inc. for use as a Through-Penetration Firestop. All firestop devices and systems shall be approved for such use by the Authority Having Jurisdiction. The firesafing system used shall maintain the fire-resistance rating of the building component that is penetrated.
- H. All materials shall be non-hardening and non-toxic. The firesafing system used shall accommodate expansion and contraction of the floating mechanical piping systems without damaging the firestop or reducing its effectiveness as a smoke barrier or water seal.

2.5 GROUT

- A. Grout shall be slow-hardening after application, volume-adjusting, non-staining, noncorrosive, non-gaseous, and recommended for interior and exterior applications.
- B. Provide ASTM C1107/C1107M, Grade B, non-shrink and non-metallic, dry hydraulic cement grout.
- C. Design Mix: 5,000 psi, 28-day compressive strength from a premixed and factory prepackage.

PART 3 – EXECUTION

3.1 HANGERS AND SUPPORTS

A. Deflection of pipes shall not exceed 1/240th (0.416%) of span.

1. Support horizontal steel/copper piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)		Hanger Rod Diameter (inches)	
	Steel	Copper	Steel	Copper
up to 1	7	5	$\frac{3}{8}$	$\frac{3}{8}$
1.25	9	7	$\frac{3}{8}$	$\frac{3}{8}$
1.5 & 2	9	8	$\frac{3}{8}$	$\frac{3}{8}$
2.5	12	9	0.5	0.5
3	12	10	0.5	0.5
3½	--	11	$\frac{5}{8}$	0.5
4	12	12	$\frac{5}{8}$	0.5
5	12	13	$\frac{5}{8}$	0.5
6	12	14	0.75	$\frac{5}{8}$

2. Support horizontal plastic piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)					Hanger Rod Diameter (inches)
	CPVC	PVC	PP	PVDF	FG	
up to 1	3.5	3	2.75	2.5	0	$\frac{3}{8}$
1.25	3.5	3	2.75	3	10	$\frac{3}{8}$
1.5 & 2	3.5	3.5	2.75	3	10	$\frac{3}{8}$
2.5	3.5	3.5	3.5	3.5	10	0.5
3	3.5	3.5	3.5	3.5	10	0.5
3½	--	--	--	--	--	--
4	4	4	4	4	10	$\frac{5}{8}$
5	4	4	4	4	10	$\frac{5}{8}$
6	4	4	4	4	10	0.75
8 & 12	--	4	4	--	12	$\frac{7}{8}$
(C)PVC: (Chlorinated) Polyvinyl Chloride Plastic; PP: Polypropylene plastic; PVDF: Polyvinylidene Fluoride Plastic; FG: Fiberglass						

- B. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item. Provide hanger on both sides of “no-hub” mechanical joints.
- C. Support hangers from concrete inserts or beam clamps. Furnish, locate and set inserts. Construct inserts of malleable iron or pressed steel with space for rods of all sizes. Install inserts for pipes 3 inches and larger in size with a reinforcing rod $\frac{5}{8}$ -inch in diameter run through a slot in the insert specifically provided for this purpose.
- D. If piping is required in a space where no inserts have been provided, drill holes in the slab (subject to Structural Engineer’s prior approval) and provide rods and hanger attached to an approved fishplate or install double expansion shields connected by a 2-inch by 2-inch angle, from which the hanger rod is to be suspended. For pipe size 2 inches and under use single shields but the hanger spacing shall be reduced to 5

feet. The carrying capacity and size of each shield shall be calculated on the basis of the spacing indicated above but the minimum size shall be $\frac{3}{8}$ -inch. Install additional shields of the same size so that the number of hangers is of adequate size to support the loads, which they carry. Shields may be used in concrete slabs only. Obtain from the expansion shield manufacturer an ICBO Evaluation Report for the product and submit to the Architect.

- E. Regardless of the type of construction (i.e., concrete, concrete-deck-steel or other variations) take particular care to support main lines and large and heavy pipes in an approved manner, including the provision of supplementary steel, if required. Supplementary steel shall be mill-rolled sections. Submit shop drawings, indicating support methods, point loadings to the building structure and hanger locations for review sufficiently in advance of concrete pouring schedules to permit evaluation, critique and any necessary changes to handling and support methods.
- F. Hangers shall be directly bolted to steel beams of building construction, where they occur if approved by the Structural Engineer. Smaller pipes shall be suspended from crosspieces of pipe or steel angles, which in turn, are securely fastened to building beams or hung from building concrete construction by means of rods and inserts. The intention is to provide supports which shall be amply strong and rigid for the load, but which will not weaken or unduly stress the building construction.
- G. Attachments to existing steel deck shall be limited to loads of 500 pounds. Heavier loads shall be supported by supplementary structural steel connected to structural beams. Provide all required supplementary steel.
 - 1. Attachments with loads up to 500 pounds shall be accomplished by drilled-in expansion shield type anchors located on the centerline of the concrete-filled ribs.
 - 2. No attachments shall be permitted to new or existing electrified decks. If hanger attachments are not existing, all new attachments shall be supported from supplementary steel.
 - 3. 500-pound load attachments shall be spaced not less than 60 inches apart, and shall be located as close to steel beams as possible.
- H. Provide approved roller support, floor stands, wall brackets, etc., for lines running near the floor or near walls, which can be properly supported or suspended by the floors or walls. Pipelines near walls may also be hung by hangers carried from approved wall brackets at a higher level than the pipe.
- I. Do not hang piping or ductwork from supports for other services. Installed supports shall accommodate free expansion of the piping and duct system.
- J. Wherever hangers using pipe rolls are used, provide approved steel pipe covering protection saddles, spot-welded to the piping at each hanger location.
- K. Anchor piping where shown to localize expansion or to prevent undue strain on piping and branches. Anchors shall be entirely separate from hangers and of heavy forged or welded construction of approved design. All anchor designs, when submitted for approval, shall include piping reactions which respective anchors are capable of supporting. Provide indicated expansion loop.
- L. Install anchors where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
- M. Support copper tubing individually by approved hangers not more than 6 feet apart. Hangers for uncovered lines shall be specially designed for copper tubing and of exact outside diameter of tubing. Hangers for covered tubing shall be broad straps fitting outside of covering.
- N. Hangers for insulated piping shall support the pipe without piercing the insulation. Refer to Section 23 07 00 – HVAC Insulation for insulation protection shields and pipe inserts.
- O. For piping 4 inches and larger, support the elbows of the piping adjacent to pumps with steel supports from the concrete housekeeping pad, or from the inertia base where pump is mounted to prevent loading heavy weights of piping on pump flanges or casing. Where inertia base or spring vibration isolation is not provided, base elbows shall be supported on concrete pad with 1-inch neoprene pad.
- P. Use hangers, which are vertically adjustable 1.5-inch minimum after piping is erected. Install hangers so that $\frac{1}{2}$ -inch minimum clearance is maintained between finished covering of pipe and adjacent work.
- Q. Support riser piping independently of connected horizontal piping.
- R. Adjust hangers to obtain pipe slope where specified.
- S. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe

supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior review.

- T. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.
- U. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123/A123M, 1.5-ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes shall be field-covered with zinc-rich paint of comparable thickness to factory coating. Corrosive atmospheres include the following locations:
 - 1. Exterior locations, parking ramps, carwash areas
 - 2. Swimming pool equipment, chemical storage or hazardous waste storage rooms
 - 3. Wet wells, meter pits
 - 4. Sanitary and storm sewer pumping stations
 - 5. Food service/kitchen areas, walk-in coolers/freezers
 - 6. Locker/shower rooms
 - 7. Greenhouses

3.2 SLEEVES

- A. Provide sleeves for pipe passing through floors, walls or partitions, hung or furred ceilings, of sufficient diameter to accommodate pipe covering where such is required. Locate sleeves secure in place so that an equal space is around the pipe, after the pipe is installed.
- B. For sleeves at penetrations of metal deck, nail, screw or weld to the deck prior to the pouring of the deck concrete. Set sleeves in such a manner so that no concrete fills their interior during the concrete pouring and finishing operations.
- C. For exposed pipes, caulk floor sleeves with firestop material watertight and project sleeve approximately 2 inches above the finished floor. Finish sleeves with specified flanges flush with the bottom of slab and also with the finished faces of wall.
- D. Provide sleeves with an inside diameter at least ½-inch greater than outside of pipe served, including pipe insulation which must be continuous through sleeve.
- E. Where piping penetrates walls (other than foundation walls), partitions, floor slabs, etc., pack space between piping and sleeve with mineral wool (for depth of sleeve), or firestop material.
- F. Do not support pipes by resting clamps on sleeves. Clamps shall extend beyond sleeve and be supported outboard of sleeve in an approved manner. In no case shall sleeves be cut or slotted to accommodate pipe clamps.
- G. Provide escutcheon plates of the proper size for piping in sleeves passing through floors, walls, soffits, furrings, partitions, hung ceilings, etc., throughout the building where exposed. Exposed escutcheons shall be cast brass chromium plated, bell type, with setscrews of sufficient diameter to include any required pipe insulation. Attach escutcheon to building material, not to pipe. Do not penetrate vapor barriers.
 - 1. Split-casting, deep-pattern type cast-brass type with concealed hinge and set screw with polished chrome-plated and rough brass finish.
 - 2. Split-casting, floor-plate type cast brass with concealed hinge and set screw.
- H. Exterior-wall pipe penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install aboveground steel pipe for sleeves smaller than 6 inches.
 - 2. Install aboveground cast-iron "wall pipes" for sleeves 6 inches and larger.
 - 3. Install underground cast-iron "wall pipes" for all sleeves.
 - 4. Mechanical Sleeve Seal Installation:
 - a. Select type and number of sealing elements required for pipe material and size.
 - b. Position pipe in center of sleeve.
 - c. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve.
 - d. Tighten bolts against pressure plates that cause sealing elements to expand and make

watertight seal.

- e. For wall thickness up to 12 inches provide one mechanical sleeve seal at the interior side of sleeve, for wall thickness greater than 12 inches provide two mechanical sleeve seals, one at the interior side of sleeve and one at the exterior side of sleeve.

3.3 FIRESTOPPING

- A. Where space for future ducts, pipes and conduits is required, provide sleeves and fill with lightweight concrete or firestop.
- B. Provide firestopping and grouting around pipes and ducts penetrating concrete slabs, concrete walls and masonry walls with cement grout in the sleeved opening extending full depth through wall or floor slab. Provide sheet metal cover over the insulation before applying grout. Around pipes and ducts through fire rated gypsum board construction, pack the annular space between the wall sleeve and the insulation sheet metal cover with noncombustible approved firestop material and finish with 20-gauge sheet metal collar on ducts and escutcheons on pipe where duct or pipework is exposed. Attach escutcheons to wall.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- D. Environmental Requirements:
 - 1. Provide adequate ventilation if using solvent.
 - 2. Provide forced-air ventilation during installation if required by manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
 - 5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- E. Clean surfaces that will be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.
- F. Install penetration seal materials in accordance with the UL Fire Resistance Directory or Mortars per Warnock Hersey approval and in accordance with manufacturer's instruction.
- G. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- H. Where large openings are created in walls or floors to permit installation of pipes, ducts or other items, close unused portions of opening with firestopping material tested for the application. See UL Fire Resistance Directory or Warnock Hersey approvals.
- I. Install smoke stopping as specified for firestopping

3.4 GROUTING

- A. Mix, install and cure grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout.
- C. Place grout, completely filling equipment bases.
- D. Place grout on concrete bases and provide smooth bearing surface for equipment.
- E. Place grout around anchors.

END OF SECTION 22 05 29

SECTION 22 13 00 – DRAINAGE SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. General: Provide complete and operable drainage systems within the intent of the Contract Documents, including but not limited to, all materials and labor for complete installation and testing, in compliance with applicable provisions and recommendations of the reference standards.

1.2 REFERENCE STANDARDS

- A. Comply with the applicable provisions and recommendations of the following codes:
 - 1. California Code of Regulations, Title 24 (California Building Standards Code)
 - 2. California Plumbing Code
- B. House drains and sewers contract limit line shall be 5 feet from building wall, or as indicated on the Drawings.

1.3 SECTION INCLUDES

- A. Drainage and vent systems, including, but not limited to the following:
 - 1. Drainage and vent piping systems
 - 2. Drainage specialties

1.4 RELATED DOCUMENTS

- A. Section 31 23 33: Trenching and Backfilling
- B. Section 22 11 00: Domestic Water Systems
- C. Section 22 05 29: Supports, Hangers, Anchors and Sleeves
- D. Section 22 11 10: Piping and Accessories

1.5 SUBMITTALS

- A. Product Data: Provide product description, list of materials and thickness for each service or equipment scheduled, locations, and manufacturer's installation instructions.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Following is a list of manufacturers whose products may be submitted for review. All items submitted as being equal, shall have same quality, finish, free area, material construction, etc., as those specified under base Specification.
 - 1. Cast Iron Piping and Fittings:
 - a. AB&I Foundry
 - b. Charlotte Pipe
 - c. Tyler Pip
 - d. Or approved qual
 - 2. Cast Iron Drainage Products:
 - a. J.R. Smith, Wade
 - b. Josam, Zurn
 - c. Mifab
 - d. Or approved equal.
 - 3. Copper Drainage Piping and Fittings:

- a. Nibco, Elkhart
 - b. Wolverine, Cerro
 - c. Or approved equal.
- 4. Sewage Ejectors/Sump Pumps:
 - a. Zoeller
 - b. Peerless Pump
 - c. Weil Pump
 - d. Paco
 - e. or approved equal
- 5. Foundry Specialties:
 - a. Flockhart Foundry Co.
 - b. Neenah
 - c. Alhambra
 - d. Or approved equal.
- 6. Low Torque No Hub Couplings:
 - a. Mission, Anaco
 - b. Tyler Pipe
 - c. Or approved equal.
- 7. High Torque No Hub Coupling:
 - a. Clamp-All
 - b. Anaco-Husky
 - c. Or approved equal.
- 8. Grease Recovery System:
 - a. Thermac
 - b. Or approved equal.
- 9. Grease Interceptors:
 - a. MIFAB
 - b. Zurn
 - c. J.R. Smit
 - d. Or approved equal.

2.2 DRAINAGE AND VENT PIPING SYSTEMS

- A. Above Grade; Sanitary Vent, Sanitary Sewer and Storm Sewer:
 - 1. No hub, service weight, cast iron soil pipe labeled with the CI mark of quality and permanence as illustrated in latest standards of Cast Iron Soil Pipe Institute Standard 301, ASTM A888 or ASTM A74, and no hub drainage pattern fittings.
 - 2. Standard Weight Galvanized Steel Pipe, Schedule 40:
 - a. Fittings: Galvanized malleable iron with flat band, steam pattern (vent piping) and cast iron drainage pattern (waste piping).
 - b. Joints: Teflon tape applied to male threads only, with no tape or loose ends extending into pipe or past the first thread of the male end. Approved grooved couplings and fittings may be used.
 - 3. Type DWV Copper and Drainage Copper Fittings. DWV copper drainage piping and fittings are not allowed on urinal waste piping. Schedule 40 galvanized steel pipe and standard weight galvanized cast iron drainage fittings.
- B. Underground; Sanitary Vent, Sanitary Sewer and Storm Sewer Pipe: Application: All underground sanitary, storm and vent piping systems under building and within 5 feet - 0 inches of the building's exterior foundation, unless otherwise noted on drawings.
- C. Underground; Sanitary Vent, Sanitary Sewer and Storm Sewer Pipe; Application: All underground sanitary, storm and vent piping systems beyond 5 feet - 0 inches from the building's exterior foundation.
 - 1. PVC Schedule 40 Solid Wall Pipe and PVC DWV Fitting System:
 - a. Pipe and fittings shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a Cell Class of 12454-B as identified in ASTM D-1784. PVC Schedule

40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D-1785 and ASTM D-2665. PVC DWV solvent cement fittings shall conform to ASTM D-2665.

- b. Pipe and fittings shall be manufactured to the nominal dimension cited in the applicable ASTM standard, and shall be made by one manufacturer. Fittings shall be injection molded. Fabricated fittings shall not be permitted. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to National Sanitation Foundation Standard 14.
- c. Joints: Solvent weld, ASTM D-2564, NSF and U.P.C. listed.

D. Indirect Waste Piping:

- 1. Unfinished Spaces: Type DWV copper tube with solder-fitting drainage type, cast copper couplings.
- 2. Finished Spaces: Chrome plated brass piping with chrome plated brass threaded drainage pattern fittings.

2.3 CLEANOUTS

A. Floor Type (FCO):

- 1. Carpeted Areas: Cast iron cleanout with round adjustable scoriated nickel bronze top, vandal proof screws, plastic plug or bronze gasketed plug, carpet clamping collar, spigot outlet; "No. 4021-U-X Series" by J.R. Smith, "No. ZN1400-CF-VP Series" by Zurn Industries, Inc., or equal.
- 2. Carpeted Areas: Cast iron cleanout with round adjustable scoriated nickel bronze top, vandal proof screws, plastic plug or bronze gasketed plug, carpet marker, spigot outlet; "No. 4021-U-Y Series" by J.R. Smith, "No. ZN1400-CM-VP Series" by Zurn Industries Inc, or equal.
- 3. Ceramic and Porcelain Tile Areas: Cast iron cleanout with square adjustable scoriated nickel bronze top with tile recess, vandal proof screws, plastic plug or bronze gasketed plug, spigot outlet; "No. 4161-U Series" by J.R. Smith, "No. ZN1400-TX-VP Series" by Zurn Industries, or equal.
- 4. Terrazzo and Similar Poured Floor Material Areas: Cast iron cleanout with square adjustable scoriated nickel bronze top with recess, vandal proof screws, plastic plug or bronze gasketed plug, spigot outlet; "No. 4201-U Series" by J.R. Smith, "No. ZN1400-Z-VP Series" by Zurn Industries, Inc., or equal.
- 5. Boiler Room and Mechanical Rooms: Extra heavy duty cast iron cleanout with round adjustable galvanized cast iron top, vandal proof screws, plastic plug or bronze gasketed plug, spigot outlet; "No. 4220-G Series" by J.R. Smith, "No. Z1400-G-VP Series" by Zurn Industries, Inc., or equal.
- 6. Wall Type(WCO) - Clean Out Wall Plate: Cast iron cleanout tee with round stainless steel cover, vandal proof screws, plastic or gasket sealed bronze plug and spigot outlet; "No. 4531-U Series" by J.R. Smith, "No. Z1446-VP Series" by Zurn Industries, Inc., or equal.
- 7. Exterior Grade Cleanout (GCO): Cast iron cleanout and double flanged housing with heavy duty scoriated cover secured with vandal proof screws, plastic or gasket sealed bronze plug and spigot outlet; "No. 4251-U Series" by J.R. Smith, "No. Z1474-IN-VP Series" by Zurn Industries, Inc., or equal.

2.4 DRAINAGE SPECIALTIES

A. General:

- 1. Drains:
 - a. Provide all required extension collars, flashing devices, etc., to suit roof, floor and deck construction in addition to features described for drains.
 - b. All drains in public areas shall include vandal proof features. All floor drains, roof drains and overflow drains shall have integral no-hub outlets when connecting to above grade sanitary piping.
 - c. Floor drain outlets connecting to buried piping shall be as style as required to comply with piping manufacturer recommendations and jurisdictional plumbing code.

B. Size of drain outlets shall be same as connecting pipe and as indicated on drawings.

C. Area Drain:

- 1.

- D. Downspout Nozzle (DSN): Cast bronze body and flange, threaded inlet same size as connecting overflow storm pipe, “Series 1770T” by J. R. Smith, “Series ZARB199” by Zurn Industries, Inc., or equal.
- E. Air Gap Fitting: Cast bronze fixed air gap with set screw on inlet, 1½-inch thread outlet, inlet size to match connecting pipe size; “Series 3950T-CP” by J. R. Smith, “Series Z1024” by Zurn Industries, Inc., or equal.
- F. Traps:
 - 1. General:
 - a. No Hub cast iron “P” Trap; “Fig No. NH43” or “NH42” and provide cast iron tailpiece with ½ inch tapping by Charlotte Pipe. Material same as piping system. Type of trap shall be approved by local codes.
 - b. Service weight cast iron “P-Trap” Fig No. SV 169 by Charlotte Pipe. Material same as piping system. Type of trap shall be approved by local code
 - c. Provide trap with trap primer connection where required for trap primer discharge piping connection to be at tailpiece of trap instead of body of drain.
 - 2. Deep Seal “P” Trap:
 - a. No Hub cast iron cast iron deep seal “P” Trap; “Fig No. NH44A by Charlotte Pipe. Hub service weight cast iron cast iron Deep Seal “P” Trap; “Fig No. NH44” by Charlotte Pipe.
 - b. Hub and spigot or service weight cast iron deep seal “P” Trap
 - c. Provide trap with trap primer connection where required for trap primer discharge piping connection to be at tailpiece of trap instead of body of drain.
- G. Auxiliary Inlet Fittings:
 - 1. No hub cast iron with ½-inch trap primer connection: “No. 2695” by J. R. Smith, “No. Z1023” by Zurn Industries, Inc., or equal.
 - 2. Hub and spigot cast iron with ½-inch trap primer connection: “No. 2697C” by J. R. Smith.

PART 3 – EXECUTION

3.1 APPLICATIONS

- A. No Hub Couplings:
 - 1. Provide low torque no hub couplings on waste, and sanitary piping 4 inches and smaller.
 - 2. Provide low torque no hub couplings on vent piping.
 - 3. Provide high torque no hub couplings on storm piping from area drains, roof drains and overflow drains.
 - 4. Provide high torque no hub couplings on sanitary and piping 5 inches and larger.
- B. Pump Discharge Piping.
 - 1. Pump discharge pipe size shall be sized for fluid velocity of greater than 2 feet per second and not greater than 6 feet per second. Piping size shall not be less than indicated on drawings:
 - 2. Provide gate or ball valve and check valve in each pump discharge piping.
- C. Auxiliary Tailpiece with Tapped Inlet: Provide auxiliary tailpiece with tapped inlet for installation on drain body outlet piping, where trap primer is required and drain body and “P” trap is provided without trap primer connection.
- D. Traps: Provide deep seal “P” traps for all floor drain and floor sink installation with trap primers, where allowed by building conditions.
- E. UV resistant paint: Provide coating on exterior of plastic pipe exposed to sun, including vents through roof.

3.2 INSTALLATION

- A. Piping:
 - 1. Make screwed joints with Teflon sealing tape and with a minimum of 3 screw threads left visible
 - 2. Nipples: Provide nipples of weight corresponding to piping. Use only shoulder nipples unless otherwise directed.
 - 3. Pitch drainage piping, unless otherwise indicated, at a minimum rate of 2 percent in direction of flow for drainage system.
 - 4. Provide capped and/or plugged connections in soil, waste and vent piping as required and where indicated on the Drawings (e.g., wet columns, tenant retail spaces) for future extension to

equipment and fixtures provided under other sections of the work.

5. Connections and Change in Direction:

- a. Make changes in direction with long sweep or bends or with 1/8 and/or 1/16 bends at cleanouts, combination “Y” and 1/8 bend branches at base of roof leader and drainage stacks and vertical piping rising to fixture waste rough-ins.
- b. Make connections of branches to mains with “Y” fittings and 1/8 or 1/16 bends.
- c. Double sanitary tees may be used when barrel of the fitting is at least 2 pipe sizes larger than the largest inlet.
- d. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
- e. Reducing size of drainage piping in direction of flow is prohibited.

6. Buried Piping: Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

B. Caulked Cast Iron Bell and Spigot Joints:

1. Make joints with lead and tarred oakum.
 - a. Use joint runner so that after pouring lead shall finish flush with bell.
 - b. Provide 1-inch minimum depth lead seal.
2. Make joints between cast iron pipe and steel, or copper pipe with fittings made especially for that purpose.
 - a. Tapped spigots
 - b. Tucker connections
 - c. Others as approved by the Architect

C. Trap Primers:

1. Refer to Section 22 11 00, Domestic Water Systems, for additional related trap primer product selection, installation and coordination required for trap primer installations.

D. Trap Primer Discharge Piping:

1. Provide trap primers discharge piping appropriate for trap primers installed for trapped plumbing drainage installations indicated on Drawings and where required by local jurisdictional codes.
2. Provide ½-inch Type “L” annealed copper tubing for trap primer discharge piping routing to auxiliary tailpiece with tapped inlets or tapped drain body with positive drainage slope towards connection.
3. Select appropriate type of connection at drainage system and provide floor drain trap primer connection within body of floor drain or provide auxiliary tailpiece with tapped connection as needed for proper installation.
4. Provide flexible unicellular insulation or flexible sealant and floor sleeve where piping passes through slab on grade.

E. Supports:

1. All horizontal cast iron no hub pipe shall be supported every 10 feet maximum, and within 6 inches at each side of each joint. When a concentration of fittings occurs, additional support shall be installed, consistent with good trade practices. All horizontal cast iron soil piping shall be supported at each horizontal branch connection.
2. All horizontal plastic pipe 2 inches and smaller shall be supported in accordance with manufacture support data based on temperature of 140° F and on each side of each joint. When a concentration of fittings occurs, additional support shall be installed, consistent with good trade practices. All horizontal piping shall be supported at each horizontal branch connection.
3. Supports for vertical piping shall be double bolt riser clamps, with each end having equal bearing on the building structure. Supports to be provided as follows:
 - a. Cast iron pipe/plastic pipe at every floor and at its base.
 - b. Threaded pipe at every other story height.

- c. All auxiliary steel and supports required for pipe supports shall be provided under this section.
 - d. Make piping rigid in piping chases using support systems to resist push or pull movement at fixture waste rough-ins.
 - e. Make piping rigid in piping chases using supports system directly attached to piping to resist push or pull movement at fixture waste rough-ins.
- F. No-Hub Cast Iron Soil Pipe:
 - 1. Where components are suspended in excess of 18 inches by means of non-rigid hangers, brace against horizontal movement (sway brace).
 - 2. 6 inches and larger: brace to prevent horizontal movement at every branch opening and change of direction by securing to building structure.
 - 3. In seismic zones 3 and 4 provide support on both sides of the No-Hub coupling on piping 5 inch and larger routing over public, high traffic areas, lobbies, and egress pathways.
- G. Flashing Fittings:
 - 1. Provide vents and all other pipes passing through roofs with a flashing fitting set at a suitable level above the roof to terminate the flashing. Arrange piping passing through roofs to be a minimum of 12 inches from walls or other obstructions so as to permit proper flashing.
- H. Drains:
 - 1. Provide floor drains and floor sinks with trap primer connections on body drain or by providing auxiliary tailpiece with tapped inlet.
 - 2. Trap primers are not required for floor sink installations in food preparation areas unless otherwise noted.
 - 3. Reset drain rims to suit final construction elevations:
 - 4. Floor Drains:
 - a. Set drain rims flush and level with finished floor in areas subject to foot traffic.
 - b. Set drain rims minus 1/8 inch to 1/4 inch from finish floor elevation, so as to provide positive drainage, where drain is not subject to foot traffic.
 - 5. Floor Sinks:
 - a. Floor sinks installed for food prep area and for indirect waste only shall be installed with rim set above finished floor.
- I. Traps:
 - 1. Refer to Section 22 11 00, Domestic Water Systems, for plumbing fixture traps.
 - 2. Provide deep seal "P" traps for all floor drain and floor sink installation with trap primers.
 - 3. Set traps level with regard to their water line.
 - 4. Traps shall be same size as connecting drain outlets.
 - 5. Provide adaptor coupling where required to connect dissimilar waste piping materials as recommended by waste piping manufacturers.
- J. Cleanouts:
 - 1. Provide cleanouts in drainage systems in accordance with the referenced standards and where indicated.
 - 2. Provide cleanouts in indirect waste lines at every change in direction.
 - 3. Cleanouts at the base of all drainage stacks with tapped tees capable of receiving a rough brass countersunk head.
 - 4. Provide brass cleanout plugs and thoroughly coat threads on removable parts with graphite.
 - 5. Provide a full size "Y" branch cleanout in sanitary house drains within 2 feet of the foundation wall.
 - 6. Provide cleanouts and related covers full size of pipes up to 4 inches inclusive, and not less than 4 inches for 6 inches, not less than 6 inches for 8 inches and 10 inches larger pipes, and not less than 8 inches for 12 inches and 15 inches.
 - 7. Install cleanouts on 3-inch or larger pipes at location to maintain minimum clearance of 18 inches.
 - 8. Install cleanouts on 1½-inch and 2-inch pipes at location to maintain minimum clearance of 12 inches.
 - 9. Provide 18-inch x 18-inch x 6-inch thick concrete pad for exterior grade clean out installed in asphalt and non-paved areas. Center exterior grade clean out in pad.

K. Vent Piping:

1. Provide vents shown on drawings, as required by Plumbing Code, and as necessary to prevent siphon age or backpressure on trap seals and to maintain air circulation and atmospheric pressure throughout drainage system.
2. Do not locate outlets of vent piping through the roof less than 25-feet, 0-inches from any air intake duct and vent shaft louver.
3. Do not terminate vent outlet less than 10 feet from, or at least three feet above any openable window, door opening, air intake vent shaft, nor less than three feet in every direction from any lot line; alley and street excepted.
4. Vent lines shall be extended separately or combined, of full required size, not less than six inches above the roof or fire wall.
5. Flag poling of vents is prohibited, except where roof is used for purposes other than weather protection.
6. All vents within 10 feet of any part of the roof that is used for such other purposes shall extend not less than 7 feet above such roof and shall be securely stayed.
7. Vent pipes installed at grade level shall be extended 10 feet above the surrounding ground and shall be securely stayed.
8. Grade vents to discharge water of condensation, where possible and do not allow reverse grade to trap water.
9. Make offsets at 45° angle wherever possible. Connect upper ends of drainage lines to vent system or extend through roof without decreasing size of vent stacks.
10. Arrange vents and related connections, except wet vent, to not carry drainage.
11. Connect bottom to drains in arrangement that where drainage washes out all rust and scale.
12. Extend portions of vents above floor line upwards to points not less than 6 inches above flood rim of highest fixture before running horizontally.
13. Run portions below floor line vertically wherever possible.
14. Do not connect main vents into soil or waste stacks lower than 6 inches above flood rim of highest fixture on stack.

L. Trap Primer Discharge Piping:

1. Provide trap primers discharge piping appropriate for trap primers installed for trapped plumbing drainage installations indicated on Drawings and where required by local jurisdictional codes.
2. Provide ½-inch Type “L” annealed copper tubing for trap primer discharge piping routing to auxiliary tailpiece with tapped inlets or tapped drain body with positive drainage slope towards connection.
3. Coordinate discharge piping routing and method of connection to inlet side of floor drain to tailpiece and insure discharge piping has positive drainage towards connection point at floor drain with no low points. Bury piping within floor slab where approved by Architect.
4. Select appropriate type of connection at drainage system and provide floor drain trap primer connection within body of floor drain or provide auxiliary tailpiece with tapped connection as needed for proper installation.
5. Refer to Section 22 11 00, Domestic Water Systems, for additional related trap primer product selection coordination required for trap primers installations.

M. Roof and Overflow Drains:

1. Provide style of drains compatible with the roof structure and roofing materials.
2. Provide roof drains with outlets size same as roof drain leader pipes indicated on Drawings.
3. Provide waterproof caulking and gasket between reversible collar and body.
4. Install drain body, sump receiver, under deck clamps, before installation of roof membrane system. Set drain flange tight to roof deck. Secure drain to roof deck with approved underdeck clamp bolted to underside of drain body. Protect roofing ballast from entering drain body or leader pipe during roofing installation. Rod clean each roof drain, area drain and overflow drain, and leaders removing all soil, refuse, and other foreign material.
5. Test flow of each drain with water in presence of Owner's Representative.

3.3 TESTING AND ADJUSTMENTS

- A. Provide testing of all installed drainage and vent systems during the progress of the work, including sanitary, laboratory, storm drainage and vent systems, and fixture roughing in sections, as directed to permit general construction and building in of rough work to proceed. Such tests shall be made in the presence of the Owner's Representative, Building Department Inspectors and all other authorities having jurisdiction. A minimum of 24 hour notice shall be given to all parties prior to any testing.
- B. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as he will be required to repair and make good, at his own expense any damage caused.
- C. Each section of drainage and vent rough-in piping tested shall have all openings tightly closed with screw plugs, or equal device, and stand without loss of level for a period of 4 hours when filled with water which produces at least a 10-foot head at the highest point of the section tested.
- D. Each section of roof and overflow drainage piping shall be tested corresponding to the full head of water attainable in each portion of the system.
- E. The drainage and vent systems shall again be tested and made tight after all plumbing fixtures are connected in place and with water seals in traps by means of standard smoke or chemical test as required by the Plumbing Inspector.

END OF SECTION 22 13 00

SECTION 22 40 40 – PLUMBING FIXTURES

PART 1 – GENERAL

1.1 SUMMARY

- A. All common areas & residential unit plumbing fixtures are specified by the Interior Design consultant. Reference the Interior Design drawings for the manufacturer, model numbers and details for all the common areas & residential unit fixtures.
- B. Section Includes:
 - 1. Water closets
 - 2. Urinals
 - 3. Lavatories
 - 4. Sinks
 - 5. Mop receptors
 - 6. Electric water coolers
 - 7. Showers
 - 8. Hydrants
 - 9. Safety equipment
 - 10. Miscellaneous fixtures

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Water Conservation: Comply with the applicable provisions and recommendations of the following Codes:
 - a. Uniform Building Code
 - b. California Plumbing Code
 - c. California State Energy Conservation Standards and handicapped requirements Title 24
 - d. California Green Building Standards (CALGreen)

1.3 RELATED DOCUMENTS

- A. Section 22 05 01: Plumbing General Provisions
- B. Section 22 11 10: Piping and Accessories

1.4 MAINTENANCE

- A. Extra Materials:
 - 1. Loose Key Handles: Provide and deliver to Owner at least 10 loose key handles for lavatory supplies and wall hydrants and yard hydrants. Obtain receipt and submit to Architect.
 - 2. Spare Flush Valves: Provide and deliver to Owner (2) spare flush valves of each type used. Obtain receipt and submit to Architect.

PART 2 – PRODUCTS

1.5 ACCEPTABLE MANUFACTURERS

- A. Vitreous China Fixtures:
 - 1. American Standard
 - 2. Kohler
 - 3. TOTO
 - 4. Or approved equal
- B. Flush Valves:
 - 1. Sloan Valve
 - 2. TOTO

3. Zurn
4. Or approved equal
- C. Closet Seats:
 1. Olsonite
 2. Beneke
 3. Church
 4. Bemis
 5. Or approved equal
- D. Carriers:
 1. Zurn
 2. Josam
 3. J.R. Smith
 4. Or approved equal
- E. Stainless Steel Sinks:
 1. Elkay
 2. Just
 3. Or approved equal
- F. Enameled Cast Iron Fixtures:
 1. Kohler
 2. American Standard
 3. Or approved equal
- G. Faucets:
 1. Chicago Faucet
 2. Kohler,
 3. American Standard
 4. Moen
 5. Speakman
 6. Symmons
 7. T & S Brass
 8. Or approved equal
- H. Traps, Stops, Supplies, Drains and Strainers:
 1. McGuire
 2. Dearborn
 3. Or approved equal
- I. Drain and Supply Insulation:
 1. McGuire
 2. Truebro
 3. Or approved equal
- J. Hose Bibbs, Wall Hydrants:
 1. Chicago Faucet
 2. J.R. Smith,
 3. Woodford,
 4. Zurn
 5. Or approved equal
- K. Showers:
 1. Symmons
 2. Bradley
 3. Or approved equal
- L. Electric Water Coolers:
 1. Filtrine
 2. Halsey-Taylor

3. Haws
 4. Elkay
 5. Or approved equal
- M. Safety Equipment:
1. Speakman
 2. Haws
 3. Bradley
 4. Or approved equal

1.6 WATER CLOSETS

- A. General Characteristics:
1. Vitreous China:
 2. Unmarked, true and level, clear, smooth and bright. Warranted not to craze, color or scale.
 3. Trap ways no less than 2¼ inches – 2-1/8 inches in diameter and fully glazed.
 4. Water surface area no less than 10 inches x 12 inches.
 5. 100 percent factory tested for hydraulic performance, and trap seal depth, meeting or exceeding ANSI/ASME Standard A112.19.2 and A112.19.6, CAN/CSA B45 and a minimum ball pass diameter of 2 inches.
 6. Fixture dimensions conforming to ANSI Standard A112.19.2.

1.7 LAVATORIES

- A. General Characteristics:
1. Faucet:
 - a. Lead-free brass materials and construction, U.L. listed certifying conformance with NSF. Standard 61, Section 9 test protocol for Residential/Drinking Water Faucets.
 - b. Operating cartridges: Compression type that closes with water pressure or a ceramic disc type.
 2. Vitreous China: Unmarked, true and level, clear, smooth and bright. Warranted not to craze, color or scale.
 3. “P” Traps and water supplies at lavatories shall be insulated in accordance with Title 24 Handicapped Requirements.
- B. Lavatory: L-2 Counter, rimless ADA Compliant

1.8 SINK

- A. General Characteristics:
1. Faucet Brass Quality Lead-free brass materials and construction, U.L. listed certifying conformance with NSF Standard 61, Section 9 test protocol for Residential/Drinking Water Faucets.
- B. Sink: :
1. Bowl: 18 gauge, type 302, stainless steel, single compartment, self-rimming, with 22-inch long x 19½-inch wide x 7½-inch D undercoated bowl, mounting clips screws and undermount clamps for casework counter top thickness of 1¼ inches to 1½-inch, and 3-hole punch; “No. LR-2219” by Elkay.
 2. Faucet: Single handle top mount mixing faucet with swing spout, aerator and 2.2 gpm maximum flow restrictor at 60 psi; “No. LK-4100” by Elkay.
 3. Supplies: Chrome plated angle supply with ½-inch x 12-inch flexible riser and ½-inch x ½-inch wheel handle stop and chrome plated cast brass set screw escutcheon; “No. 2167-F” by McGuire.
 4. Strainers: Basket strainer with 1½-inch x 4-inch tailpiece; “No. 151” by McGuire.
 5. Trap: 1½-inch x 1½-inch chrome plated cast trap with 17-gauge tubing waste to wall, cleanout plug and chrome plated cast brass set screw escutcheon; “No. 8912” by McGuire.
- C. Sink: :
1. Bowl: 18-gauge, Type 302, stainless steel, two compartment, self-rimming, 33-inch long x 19½-inch wide x 7½-inch diameter undercoated bowl, mounting clips screws and undermount clamps for casework counter top thickness of 1¼-inch to 1½-inch, and 3-hole punch; “No. LR-3319” by Elkay.

2. Faucet: Single handle top mount mixing faucet with swing spout, aerator and 2.2 gpm maximum flow restrictor at 60 psi; “No. LK-4100” by Elkay.
3. Strainer: Basket strainer or offset type drain as required for installation; “No. LK-35” by Elkay.
 - a. Continuous feed type, high polish sink flange, stainless steel grind chamber, grind wheel and shredder ring. 5/8 HP, 115 volts, 60Hz, “KCDC250X” by Kitchen Aid, or “No. 333” by In-Sink-Erator.
4. Trap: 1½-inch x 1½-inch chrome plated cast trap with 17-gauge tubing waste to wall, cleanout plug and chrome plated cast brass set screw escutcheon; “No. 8912-F” by McGuire.
5. Dishwasher Tailpiece and Supply Stop:
 - a. Tailpiece: Sanitary Dash R7591 or R7592, 17-gauge slip joint inlet dishwasher branch.
 - b. Supply: Provide ½-inch separate rough in for dishwasher chrome plated brass supply wheel handle stop. Verify size of outlet connection required for connection to dishwash

1.9 ELECTRIC WATER COOLER

A. General Characteristics:

1. Lead-Free Requirements: Provide all waterway components constructed of lead-free materials and conforming to definition of “lead-free” as defined in Safe Drinking Water Act of 1986 and Lead Contamination Control Act of 1988.

B. Electric Water Cooler: ADA Compliant Installation:

1. Barrier-free water cooler model with mounting assembly, bubbler, push-actuating mechanism, recessed refrigeration unit, providing 8 gph at 50° F, electrical 425W, 115V, 60Hz, single phase. Unit shall have satin stainless steel finish “HWDFS8” by Haws.
2. ADA compliant design, stainless steel cabinet, wall hung, two level, 14-inch diameter bowls, electric refrigerated water cooler; “Two Level SwirlFlo No. ERP2-8-C” by Elkay.
 - a. Stream Projector: Flexible polyester elastomer hooded stream projector with self-closing push bar controls mounted on front and built-in flow regulator from 20 to 100 psi.
 - b. Compressor: 1/5 H.P., capacity 8.0 GPH of 50 degree F water with 80 degree F inlet water and 90 degree F ambient air.
 - c. Trap: 1¼-inch x 1¼-inch, cast brass DWV “P” Trap with union joint or slip joints.
 - d. Supply Stop: ½-inch x 3/8-inch IPS chrome plated brass supply stop with wheel handle.
 - e. Dielectric coupler: ½-inch.
 - f. ½-inch non-metallic strainer downstream of supply stop.
 - g. Spout Height: Lower spout height 3 feet-0 inches above finished floor.

1.10 MOP RECEPTORS

A. Mop Receptor: :

1. Basin: 36-inch x 24-inch, one piece “molded-stone” mop sink; “No. MSB 36” inch x 24 inch by Fiat and vinyl bumper guard “No. E-77-AA” by Fiat with 3-inch outlet and following accessories:
 - a. Faucet: Combination hose end faucet with brass vacuum breaker, integral stops, pail hook, top brace and polished chrome plated brass body and handle construction; “No. SC-5811” by Speakman.
 - b. Hose and hose bracket: “No. 832-AA” by Fiat.
 - c. Mop hanger bracket: “No. 889-CC” by Fiat.

1.11 SHOWERS

- ### A. Shower – ADA Compliant Installation:
- ADA compliant design, with shower head on side wall opposite seat with shower controls on side wall opposite seat and on entry side of stall, recessed mount shower panel unit, constructed of 14-gauge 304 stainless steel polished to No. 4 finish, unit without seat; completely factory assembled, pre-piped and ready for installation and connection to shower supply piping; “HN200-SX” by Bradley, including:

1. Pressure Balance Mixing Valves: ADA compliant lever handle, bronze valve body, housing cap and renewable seat, single bronze stem and housing, stainless steel balancing piston, adjustable limit stop to limit turn of handle, supply stops; “Safteymix Pressure Balancing Valve” by

Symmons.

2. Shower Heads: Includes hand-held shower head with swivel connector and bracket, 59-inch stainless steel extra heavy duty flexible hose, chrome plated elbow outlet with in-line backflow preventer and quick disconnect, and fixed direction severe service 2.5 gpm shower head.
 3. Accessories: Lever handle diverter valve, recessed soap dish, grab bar.
- B. Shower: Single shower station, 18-gauge, 304 stainless steel shower panel, recessed soap dish, pressure balance mixing valve and severe service shower head with volume control; “Adapt-A-Brad” by Bradley with following additional features.
1. Pressure Balance Mixing Valve: Lever handle, bronze valve body, housing cap and renewable seat, single bronze stem and housing, stainless steel balancing piston, adjustable limit stop to limit turn of handle, supply stops; “Safetymix Pressure Balancing Valve Mixing” by Symmons.
 - a. Mount valve 5 feet-3 inches above finished floor.
- C. Shower Head: Heavy cast brass construction with triple chrome plated finish, 2.5 gpm water saving flow restrictor, tamper proof volume control, and design prohibiting lime build up.
- a. Install unit with shower nozzle outlet 6 feet-6 inches above finished floor measured.

1.12 HYDRANTS

- A. General Characteristics: Manufactured with “No lead” brazing rings and USDA approved lubricants.
- B. Wall Hydrants HB-1: Warm climate type box type wall hydrant with integral vacuum breaker in conforming to ANSI A112.21.3, 20 gauge stainless steel box and 16 gauge stainless steel frame and cover, ¼ turn valve operation, T-handle key operated locking cover with continuous stainless steel hinge and full 180° cover opening design, ¾-inch straight sweat inlet connection; “No. 5509QT-SAP-SS” by J. R. Smith.
- C. Hose Bibs HB-2: Cast brass wall faucet designed so that removal of vacuum breaker makes hose connection impossible, vacuum breaker complying with ASSE Standard 10; “No. Y24” or “No. 24 CP” by Woodford with “Model 34HF” by Nidel with ¾-inch inlet.

1.13 SAFETY EQUIPMENT

- A. Eye Wash/Body Wash: Deck mounted dual purpose eye wash/drench hose unit with two gentle spray outlet heads at 45° and squeeze valve with locking clip and vacuum breaker; “No. EW1022 -BP” by Water Saver.
- B. Emergency Eyewash Mixing Valve:
1. Mixing Valve: Chrome plated mixing valve shall control outlet temperature over a wide range of flow and shall be suitable for single or multiple eyewash applications. The valve shall include a thermometer to measure the temperature of the stream. Temperature adjustment shall be vandal resistant. The control mechanism shall employ a liquid filled thermostatic motor to drive the valve without additional power requirements. The control mechanism shall employ a stainless steel sliding piston control device with reverse seat closure and both fixed and variable cold water bypass. In the event of interruption of the cold water supply, the control mechanism closes off the hot water port, stopping all flow. In the event of interruption of the hot water supply, the control mechanism shall allow cold flow through both the fixed and variable bypass.
 2. Recessed Cabinet: 23 inches tall x 19 inches wide x 6 ¾ inches deep, stainless steel construction.

1.14 MISCELLANEOUS

- A. Washer Wall Box: Supply and drain unit for automatic washers constructed from hot dipped galvanized steel 20-gauge box and 18-gauge faceplate; “FB200 – 2 inch Drain” by Guy Gray.
- B. Sanitary Sealant: Acetoxy silicone sealant, white, complying with FS TT-001543A, Type 2 (non-sag), Class A, listed by NSF to be in compliance with No. F-51 “Plastic Materials and Components for Use in Food Equipment”, in compliance with FDA Reg. 21 CFR 175.300 “Resinous and Polymeric Coatings” “SCS 1702F® Sealant” by G.E. Silicones.

PART 3 – EXECUTION

2.1 INSTALLATION

- A. Provide plumbing fixtures and trim as shown on the Drawings and as specified. Vitreous china fixtures shall be white, except as otherwise noted.
- B. Provide each fixture with all required trim, including but not limited to, carriers, supports, faucets, stops, waste fitting, traps, seats, flushometer, vacuum breaker, bolts, gaskets, and escutcheons.
- C. Provide chromium plated brass materials for exposed supplies, stops, valves, faucets, strainers, wastes, bolts, screws, bushings, traps and nipples, exposed piping and wall flanges plates and escutcheons.
- D. Fixture traps shall be “P” Traps.
- E. During course of construction cover exposed trim and fittings, fixtures with suitable protection. When directed, thoroughly clean fixtures and fittings.
- F. Be fully responsible for protection of fixtures before and after inspection until final acceptance of the entire building by the Owner. The contractor regardless of who caused the damage shall immediately replace any damaged fixture.
- G. Provide fixtures free from imperfections, true as to line, angles, curves and color, smooth, watertight, and practically noiseless in operation.
- H. Alternate products shall have clearances, waterways and assembly equal to that of the plate number of the product selected.
- I. Lavatory supports shall be furnished with lavatories for under counter installation. Securely fasten and support all fixtures. Provide blocking in walls as required to support fixtures. Conceal all supports. Use expansion shields or toggle bolts for fastening to masonry. Carefully drill holes to avoid chipping, cracking, etc. Paint exposed ironwork with enamel.
- J. Provide chromium plated, cast brass escutcheons with set screws at supply and drain penetrations through walls and casework.
- K. Provide chromium plated brass materials for exposed supplies, stops, valves, faucets, strainers, wastes, bolts, screws, bushings, traps and nipples, etc.
- L. Securely fasten and support supply and drain piping in pipe chases and walls to obtain rigid installation.
- M. Securely fasten and support all fixtures. Provide blocking in walls as required to support fixtures. Conceal all supports. Use expansion shields or toggle bolts for fastening to masonry. Carefully drill holes to avoid chipping, cracking, etc. Paint exposed ironwork with enamel.
- N. Furnish electrical power requirements for fixtures requiring power, including but no limited to connection type and rough-in location to electrical work install.
- O. Provide sanitary sealant for fixture installations:
 - 1. Apply sealant to a clean and dry surface at temperatures between 20° and 90° F. Use rubbing alcohol to clean surface before applying sealant. Cut opening on spout at desired angle to dispense sealant. Apply sealant with any standard caulking gun. Smooth off excess as recommended by manufacturer.
 - 2. Caulk between walls hung vitreous china fixtures and wall with sanitary sealant.
 - 3. Caulk between self-rimming counter mounted vitreous china fixtures and counter top of casework with sanitary sealant.
 - 4. Caulk between floor set vitreous china fixtures and floor with sanitary sealant.
 - 5. Caulk between wall mounted shower valve escutcheon plate and ceramic tile with sanitary sealant.
 - 6. Caulk between shower head wall plate and ceramic tile with sanitary sealant.
 - 7. Caulk between wall hydrant and wall opening with sanitary sealant.
- P. ADA Compliant Installations:
 - 1. Install ADA compliant plumbing fixtures in conformance with Title III of American Disabilities Act Guidelines and ANSI Standard A112.19.2.
 - 2. Install ADA compliant wall type water closets at 18 inch from finished floor to top of seat.
 - 3. Install ADA compliant water closets with centerline of water closet at no less than 18 inch from adjacent wall with grab bar.

4. Install ADA compliant flush valve controls for water closets pointing to wide side of toilet area at no more than 44 inches above finished floor.
 5. Install ADA compliant urinal at 17 inches from finished floor to rim of lip.
 6. Install ADA compliant lavatories with bottom of fixture apron at no less than 29 inches above finished floor and minimum knee space of 27 inches from finished floor for distance of 8 inches from front of apron and with distance of finished floor to fixture basin rim set at 34 inches. Offset drain rough in, right or left of standard drain rough-in location, to allow offset drain to be installed and "P" Trap centerline to be parallel with face of wall.
 7. Install ADA compliant sinks in ADA compliant casework supplied by Casework Installer. Locate sink casework cutout in countertop to allow drain, tailpiece, supplies and trap to be installed within casework. Coordinate sink cutout location, accessories, rough-in and connection dimensions with Casework Installer and casework shop drawings. Do not route piping through 9-inch high toe space clearance at base of cabinet.
 8. Install ADA compliant lavatory in ADA compliant casework supplied by Casework Installer. Locate lavatory and accessories in countertop to allow drain, tailpiece, supplies and trap to allow for minimum knee space of 27 inches from finished floor for distance of 8 inches from front edge of counter. Coordinate accessories, lavatory cutout location, and rough-in and connection dimensions with casework shop drawings to meet the ADA installation criteria. Do not route piping through 9 inches high toe space clearance at base of cabinet.
 9. Install ADA compliant washfountains with bottom of fixture apron at no less than 29 inches above finished floor and minimum knee space of 27 inches from finished floor for distance of 8 inches from front of apron.
 10. Install ADA compliant electric water coolers with spout orifice 3 feet-0 inches above the finished floor.
 11. Install ADA compliant drinking fountains with spout orifice 3 feet-0 inches above the finished floor.
- Q. Standard Fixture Installations (Fixtures not identified to be installed in compliance with ADA guidelines shall be installed in accordance with the following, unless otherwise indicated on architectural documents):
1. Lavatories: Install lavatories with top of lavatory bowl 31 inches above finished floor.
 2. Wall hung water closets: Install wall hung water closets with rim at 15 inches above finished floor.
 3. Wall hung urinals: Install wall hung urinals with rim at 24 inches above finished floor.
 4. Electric water coolers with spout 40 inches above the finished floor.
- R. Washer Wall Box: Provide deep seal "P" Trap and standpipe to washer wall box connection.
- S. Electric Water Coolers: Flush strainer clean of sediment and adjust water flow regulator valve on unit to deliver stream to approximately 6½ inches from the bubbler.
- T. Mop Receptor:
1. Install mop hanger bracket centered along length of mop receptor on wall adjacent to faucet with fasteners at 4 feet-0 inches above finished floor.
 2. Install faucet water supply rough-ins at 3 feet-0 inches above finished floor and centered above mop receptor.
 3. Install top of mop bracket at 18 inches above finished floor and centerline of mop bracket 8 inches to left or right of the centerline of faucet.
- U. Hydrants:
1. Establish location of wall hydrants rough in and confirm wall-opening sizes with General Work Prime Contractor.
 2. Exterior Hydrant: Install centerline of wall hydrant at 1 foot-7 inches above finished floor, unless otherwise indicated.
Note to Specifier: Coordinate elevation of hydrant with architectural work and revise this description as necessary to match architectural elevation drawings. Watch out for exterior grade elevations which may set hydrant up higher than prudent. Hydrant elevations should be set from finished floor elevations.
 3. Interior Wall Hydrants: Install centerline of wall hydrant at 1 foot-7 inches above finished floor, unless otherwise indicated.

Note To Specifier: Coordinate elevation of hydrant with architectural work and revise this description as necessary to match architectural elevation drawings. Watch out for exterior grade elevations which may set hydrant up higher than prudent. Hydrant elevations should be set from finished floor elevations.

4. Hose Bibs: Install hose bib with supply inlet centerline at 2 feet-0 inches above finished floor.
5. Multiple Lavatory Faucet Thermostatic Mixing Valve: Locate below lavatory behind lavatory basin enclosure and on wall.

END OF SECTION 22 40 40

SECTION 23 05 01 – HVAC GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions and Division 1 are a part of the requirements for the work under this Division of the Specification.

1.2 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the heating, ventilating, air conditioning systems as called for in the Contract Documents and according to applicable codes and regulations.
- B. Provide labor, materials and accessories required to provide complete operating mechanical systems as described or which may be reasonably implied as essential for a complete operating system.

1.3 QUALITY ASSURANCE

- A. Comply with current governing codes, ordinances and regulations of the Authority or Authorities Having Jurisdiction over any part of the work and secure all necessary permits. Comply with the regulations and requirements of the Owner's insurance underwriter.
- B. Where codes or standards are referenced, the current edition and applicable portions apply, unless noted otherwise.
- C. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.
- D. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress during the Contractor's working hours. A report will be issued to the Contractor if the field review of the mechanical systems construction has revealed elements of the work, which are inconsistent with the Contract Documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks and corrections in the field shall be made as directed.

1.4 ABBREVIATIONS AND DEFINITIONS

- A. Abbreviations:

1.	AABC	Associated Air Balance Council
2.	ABMA	American Bearing Manufacturers Association
3.	ADC	Air Diffusion Council
4.	AGA	American Gas Association
5.	AHRI	Air Conditioning and Refrigeration Institute
6.	AMCA	Air Movement and Control Association
7.	ANSI	American National Standards Institute
8.	ASA	Acoustical Society of America
9.	ASCE	American Society of Civil Engineers
10.	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
11.	ASME	American Society of Mechanical Engineers
12.	ASTM	American Society for Testing and Materials
13.	AWWA	American Water Works Association
14.	BSI	British Standards Institution
15.	CTI	Cooling Tower Institute

16.	EPA	Environmental Protection Agency
17.	ETL	ETL SEMKO
18.	FM	Factory Mutual
19.	IEEE	Institute of Electrical and Electronic Engineers
20.	ISO	International Organization for Standardization
21.	MSS	Manufacturers Standardization Society
22.	NAAMM	National Association of Architectural Metal Manufacturers
23.	NEBB	National Environmental Balancing Bureau
24.	NEMA	National Electrical Manufacturers Association
25.	NFPA	National Fire Protection Association
26.	NIOSH	National Institute for Occupational Safety and Health
27.	NSF	National Sanitation Foundation
28.	OSHA	Occupational Safety and Health Administration
29.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
30.	UL	Underwriters Laboratories Inc.
31.	ULC	Underwriters Laboratories of Canada

B. Definitions:

1. Where it is stated in the specifications to submit to Architect or Engineer for review, refer to Architectural General and Special Conditions for proper procedures.
2. “PROVIDE” means to “Furnish” and “Install”. “INSTALL” means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
3. “FURNISH” means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.
4. “AS DIRECTED” means as directed by the Architect, or the Architect’s Representative.
5. “SUBMIT” means submit to the Architect for review.

1.5 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with Contract Documents. Guarantee work against faulty and improper material, fabrication, installation, start-up and commissioning for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, at no additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

1.6 USE OF THE ARCHITECT’S AND ENGINEER’S DRAWINGS

- A. The Contractor shall obtain, at the Contractor’s expense, from the Architect or Engineer a set of digital data files in Autodesk REVIT compatible format architectural and engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Architect and Engineer a written release of liability acceptable to the Architect and Engineer prior to receiving the electronic media files.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.
- B. Products and materials shall not contain asbestos, PCBs or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect.
- D. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.
- E. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.
- F. Install materials and equipment with qualified trades people.
- G. Maintain uniformity of manufacture for equipment used in similar applications and sizes.
- H. Applicable equipment and materials to be listed by Underwriters Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by Authorities Having Jurisdiction. The energy-using products shall be certified for use in the State of California and meet State energy efficient standards.
- I. Fully lubricate equipment when installed.
- J. Do not operate air systems until ductwork is complete, temporary filters are in place and construction debris is removed. Provide 1-inch thick fiberglass filter media across the face of each return air opening prior to start of each air system during temporary system operation and system clean-out.
- K. Install floor-mounted equipment on a minimum 4-inch high concrete pad. Concrete work shall be provided by another trade. Coordinate size and location with actual equipment used and accepted layout shop drawings.
- L. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in concrete under entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.
- M. Locate valves, traps, damper operators, access doors, etc., to be easily accessible, either in mechanical spaces or through access panels specified. Obtain Architect's approval of access panel locations.
- N. Follow manufacturers' recommendations and instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- O. Equipment capabilities, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on shop drawings.

2.2 ALTERNATIVE EQUIPMENT AND MATERIALS

- A. Contract Documents are based on materials specified and on equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the quality and performance as stated or implied in the Contract Documents.
- B. Equipment manufacturers listed in individual sections are acceptable for this project, subject to requirements of Contract Documents.
- C. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed alternative whether alternative is accepted or rejected.
- D. Include revisions required to adapt alternatives in such proposals, including revisions by other trades. No increase in the contract price will be considered to accommodate the use of alternative equipment.
- E. Wherever quality standards (such as serviceability, energy efficiency, longevity or durability) and operating results (such as noise levels, quantity delivered or pressure obtained) are specified or scheduled, or when the manufacturer and size of equipment, for which such operating results are published or determinable, is specified, the substitution being proposed must conform substantially to the quality and quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.
- F. In making a request for a proposal for alternative equipment or materials, the Contractor:

1. Represents that the Contractor has personally examined the Contract Documents and has determined that the proposed substitution is appropriate for the use intended in the Contract Documents and is equal or superior in all aspects to that specified.
 2. Represents that the substitution has received the necessary approvals of the Authorities Having Jurisdiction.
 3. Will coordinate installation of the accepted substitution into the work, making such changes as may be required for the work to be complete in all aspects.
- G. Proposed changes and substitutions of systems, equipment and manufacturers shall be submitted and include the following information with the proposal:
1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to other trades.
 2. Schematic drawings and details to supplement the description.
 3. A list of the contract requirements that must be revised if the change is accepted, including any specification revisions.
 4. Complete list of materials and equipment proposed for use in the change.
 5. Include a description and estimate of costs the Owner may incur in implementing the change, such as additional space requirements, permits, architectural and aesthetic impact, design costs, tests, permits evaluation, operating and support costs.
 6. A projection of any effects the proposed change would have on collateral costs to the Owner.
 7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
 8. A statement indicating the reduction to the contract price if the Owner accepts the change. Be responsible for appropriate modifications to all trades.

PART 3 – EXECUTION

3.1 FEES

- A. Pay all required fees and obtain required permits related to the mechanical installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.
- C. Provide controlled or witnessed inspection where required by Authorities Having Jurisdiction or by these specifications.

3.2 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. After receiving notice to proceed from the Owner or Owner's Representative, or after execution of Owner/Contractor Agreement, submit a complete list of all mechanical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project as well as names of all subcontractors.
- C. After receiving notice to proceed from the Owner or Owner's Representative or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the specification sections or drawing number, and an item description. Prefix the submittal identification number by the specification sections to which they apply. Indicate, on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as

required to comply with the Contract Documents and the shop drawings.

- E. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments does not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- F. No part of the work shall be ordered, procured, started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted, reviewed and returned with either “No Exceptions Noted” or “Exceptions Noted” marked on the submission.
- G. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Architect/Engineer’s office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.
- H. Submit all required shop drawings and manufacturer’s product submittals in electronic portable document format (PDF) through a file sharing website or as required by the Owner’s Representative or Architect. Review comments will be marked up electronically in the submittals and returned to the Owner’s Representative or Architect. Hard copy paper submittals will not be accepted. Electronic submittals shall be provided with the following information and format:
 - 1. Provide each submittal as a complete indexed file incorporating all requirements of the specific submittal section being submitted for review.
 - 2. Name file with project identifier, submittal number and revision number.
 - 3. Include the following minimum information as metadata in the electronic PDF file:
 - a. Project Name
 - b. Specification Section Number and Title
 - c. Drawing/Detail Reference Numbers (as appropriate)
 - d. Manufacturer Name
 - e. Product Name
 - 4. Provide electronic transmittal form with the following information:
 - a. Project Name
 - b. Date Initiated and Date Due
 - c. Contact Details for Owner, Architect and Engineer
 - d. Name of Contractor, Sub-Contractor, Manufacturer and/or Supplier
 - e. Type of Submittal
 - f. Specification Section Number and Title
 - g. Drawing/Detail Reference Numbers (as appropriate)
 - h. Indication of Partial or Full Submittal
 - i. Stamp Page for Submittal Stamps.
- I. Submissions will be stamped as follows:

Stamp	Interpretation
No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
Exceptions Noted: - Resubmit for Record - No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents and Engineer’s notations are complied with. Within this category are two options. A resubmission for our records is required when corrections are necessary. A resubmission is not required if there are only minor comments.
Revise and Resubmit	The submittal does not comply with the Contract Documents; do not proceed with fabrication,

	manufacture, or construction. The work and shop drawings are not permitted at the job site. Resubmit appropriate shop drawings.

- J. Submit materials and equipment by manufacturer, trade name and model number. Include clear, legible copies of applicable brochure or catalog material. Maintenance and operating manuals are not suitable substitutes for shop drawings.
- K. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as voltages, motor efficiencies, special tank linings, pump seals, materials or paint finishes. Cross out all references to “options”. Cross out statements such as “subject to change without notice” or “not for construction”. Anything not specifically excluded is assumed to be included.
- L. Provide dimensional data for roughing in and installation including required maintenance and service access clearances. Include technical data sufficient to verify that equipment meets requirements of the Contract Documents. Include wiring diagrams showing factory installed and field wiring requirements, piping and service connection data, motor sizes complete with voltage ratings, and schedules.
- M. Maintain a complete set of the most current reviewed and stamped shop drawings and product data on site.
- N. Prepare and submit detailed shop drawings for ductwork, piping work and other distribution services in minimum ¼-inch to 1-foot scale, including elevations and locations and sizes of openings in floor decks, walls and roofs.
- O. The work described in shop drawing and product data submittals shall be carefully checked by all trades for clearances (including those required for code compliance, maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. Each submitted shop drawing to include a certification that related field conditions and requirements have been checked by all Contractors and Subcontractors and that conflicts do not exist.
- P. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions or for deviations from requirements in the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.
- Q. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.
- R. Indicate the following in the lower right-hand corner of each shop drawing, and on the front cover of each product data brochure: the submittal identification number; title of the sheet or brochure; name and location of the Project; names of the Architect, Engineer, Contractor, Subcontractor, Manufacturer, Supplier, and Vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures, test reports or submittals consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of shop drawings or product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

3.3 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. The Contract Documents show the general arrangement of equipment, ductwork, piping and accessories. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- C. Certain products will be provided by other trades. Examine the Contract Documents to ascertain the requirements for installation of these products.

- D. Carefully check space requirements with other trades to ensure that material can be installed in the spaces allotted.
- E. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (valves, dampers, coils, etc.) requiring access in order that the ceiling and partition contractors can install access doors and panels in the correct locations.
- F. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.
- G. Furnish and set sleeves for passage of pipes, ducts and conduits through structural masonry and concrete walls, roofs and floors and elsewhere as will be required for the proper protection of each pipe and duct passing through building surfaces.
- H. Install firestopping around all pipes, conduits, etc., which pass through rated walls, partitions and floors in strict accordance with the manufacturer's published approval listing and rating.
- I. Provide detailed information on openings and holes required in structural elements and pre-cast panels or components for mechanical work.
- J. Provide required structural or architectural supports and hangers for ductwork, piping and equipment, designed so as not to exceed allowable loadings of structures.
- K. Examine and compare the Contract Drawings and Specifications with the drawings and specifications of other trades, report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of record drawings.
- M. Before commencing work, examine adjoining work on which this work is in any way dependent and report conditions that prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- N. Adjust location of pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.
 - 1. Right-of-Way: Lines which pitch have right-of-way over those which do not pitch. For example: condensate and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - 2. Provide offsets, transitions and changes in direction of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required to effect these offsets, transitions and changes in direction.
- O. Install mechanical work to permit removal (without damage to other parts) of hydronic coils, heat exchanger, boiler or chiller tube bundles, heat exchanger plates, controls, fan shafts and wheels, smoke detectors, filters, belt guards, sheaves and drives, and any other parts requiring periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit access to valves, cocks, traps, starters, motors, and control components, and to clear the openings of swinging doors and access panels.
- P. Changes in the cross-sectional dimensions of ductwork are permissible when required to meet job conditions. Maintain at least the same equivalent cross-sectional duct area in accordance with the latest edition of the ASHRAE Guide. Secure the approval of the Architect prior to fabrication of ductwork requiring these changes.
- Q. Provide access panels in equipment, ducts, etc., as required for inspection and maintenance of concealed or internal equipment, dampers, plenums, smoke detectors, humidifiers, controls, etc.
- R. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary instructions from the Architect.

3.4 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the

Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as piping, busway, conduit, ductwork, etc., including conduit embedded in concrete floors and walls. The Coordination Drawings shall be submitted complete to the Architect and the Engineer after notice to proceed is given and in compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than ¼-inch to 1-foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate Trade Contractor shall draw their work on separate layers with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and Coordination Drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost to the Owner.
- C. The Contractor's Coordination Drawings shall indicate structural loads at support points for all piping 10-inch and larger, racked piping, racked conduit and busway. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Architect to change them.
- E. Prior to final acceptance of the work, the Contractor shall submit the Coordination Drawings as part of the Record Drawing submittal.

3.5 EXAMINATION OF SITE

- A. The Contract Documents do not make representations regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.6 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or as required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95 percent of standard proctor density or 75 percent relative density or as specified by

the Architect. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

- C. Excavate trenches for utilities that will provide the required minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.
- D. Trenches shall not be placed within ten (10) feet of foundation or soil surfaces that must resist horizontal forces.
- E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive material with limited porosity. Deposit backfill in 6-inch thick layers and tamp carefully until the mechanical work is covered by not less than 12 inches of material. Backfill and tamp remainder of trench at 1-foot intervals until complete. Uniformly grade the finished surface.

3.7 CUTTING AND PATCHING

- A. Where cutting, channeling, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- B. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect.
- C. Where ductwork, piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

3.8 PROHIBITED LABELS AND IDENTIFICATIONS

- A. Prohibited Markings: In all public areas, tenant areas, storage areas and similar locations within the project, the inclusion or installation of any equipment, fixture or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Exception: Required Underwriters Laboratories labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

3.9 EQUIPMENT PAD AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted mechanical equipment. This includes electrical components, equipment mounted on legs and pipe support stands. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 2-inch margin around the equipment and supports. Pads shall be a minimum of 4-inches high and made of a minimum 28-day, 2,500-psi concrete reinforced with 6-inch by 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a 3/4-inch radius. Use shop drawings stamped "NO EXCEPTIONS NOTED" or "EXCEPTIONS NOTED" for dimensional guidance in sizing pads.
- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Verify bolts size, number and embed depth recommended by the manufacturer of the equipment with seismic calculations as specified, and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation and seismic restraint manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws will pass through the gypsum board and be securely attached to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6-inch square, 18-gauge galvanized metal backplates that are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

3.10 DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified

and be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.

- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost to the Owner.

3.11 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials and equipment until finally inspected, tested and accepted. Protect work against theft, injury or damage; and carefully store material and equipment received on site that is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, moisture, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry heated spaces.
- C. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.12 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

- A. Do not install piping, equipment or ductwork for heating, ventilation, air conditioning, plumbing or any piping systems not included as part of the electrical work, in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.
- B. Do not install piping, equipment or ductwork above switchboards, disconnects, panelboards, dimmers, control panels, VFDs, motor control centers, individual motor controllers, electronics, etc or the code-required service space for these electrical devices.

3.13 EQUIPMENT GUARDS

- A. Provide removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts of machinery. Provide tachometer openings in the guards at least 2-inches in diameter, for all belt-driven, gear-driven or variable speed machinery. Comply with OSHA requirements for all equipment guards.

3.14 LUBRICATION

- A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.
- B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.15 DATE OF COMPLETION AND TESTING OF MECHANICAL SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing and commissioning prior to occupancy and the Contract closeout. Complete any adjustments and/or alterations that the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and

outlining when tests and commissioning will be performed. Update this schedule periodically as the project progresses.

3.16 TITLE 24 ACCEPTANCE TESTING

- A. The Contractor is to act as the Responsible Person for all acceptance tests required per the California Energy Efficiency Standards, Title 24, Part 6.
- B. The acceptance requirement process must address the following:
- C. Construction Documents Plan Review.
- D. Review the installation, and complete the required acceptance testing.
- E. Certify the acceptance test results on the Certificate of Acceptance.
- F. Submit the Certificate to the Building Department prior to receiving a final occupancy permit.

3.17 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and systems specified and train the Owner's operating and maintenance personnel for a three (3) day operating/instruction period. Operating instruction time is defined as straight time working hours and not including nights, weekends or travel time to and from the project. Refer to individual sections for additional training and instruction by manufacturer's trained specialists.
- B. Notify the Owner in writing at least three (3) weeks before the operating/instruction period begins. Do not commence until the Owner has issued written acceptance of the starting time and schedule.
- C. In addition to the operating/instruction period, organize and conduct a seminar to instruct the Owner's Representatives in the operation and general preventative maintenance of equipment and systems provided at the completion of the project.
- D. Instruct Owner's operating personnel in the basis of design, available project documentation, proper starting sequences, operation, shut-down, and maintenance procedures. Instruction for both normal and emergency operations procedures shall be provided and documented.
- E. Make arrangements to give instructions by system and not by building areas. Organize training session and the video recording to present segments for equipment types, and overall systems following the Table of Contents of the Operating and Maintenance manuals.
- F. Provide services of qualified personnel, including each sub-trade, each major equipment supplier to attend seminar and instruct on respective equipment or systems. Seminar shall be conducted by the Contractor and shall be professionally videotaped with lighting and narration. The seminars may be attended by the Architect or Architect's Representative.
- G. Submit seminar agenda, schedule and list of representatives to the Owner for review thirty (30) days prior to seminar. Confirm attendance at seminar by written notification to participants.
- H. At seminar, submit final copies of record drawings and operating and maintenance manuals to Owner.
- I. Submit a written record of the seminar, complete with an attendance list to the Owner.
Provide two copies of the recorded training video on USB flash drives.

3.18 OPERATING AND MAINTENANCE MANUALS

- A. Provide operating instructions and maintenance manuals for all equipment and materials furnished under this Division. Manuals shall be available at the operations training seminar.
- B. Submit a draft copy of operating and maintenance manuals in PDF format for review at least ten (10) weeks before the completion date. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.
- C. After the Architect's and Engineer's review, and any required Contractor revisions, the operating and maintenance manuals shall be delivered to the Owner as three (3) hard paper copies in a binder as described below and separately on electronic media in PDF format.
- D. Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8.5-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 1. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the

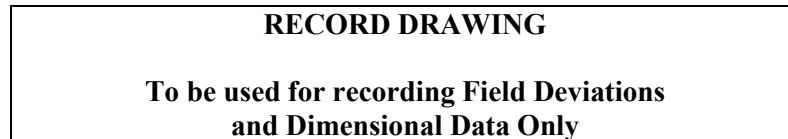
- manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross referenced to Specification Section number and title of Project Manual.
3. Supplementary Text: Prepared on 8.5-by-11-inch white bond paper.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Manual Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system.
- F. Maintenance information shall include complete lubrication, cleaning, and servicing data compiled in clearly and easily understandable format. Show model and serial number of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- G. Provide the following equipment operating and maintenance information where applicable:
1. Identifying equipment manufacturer, product name, model number and number
 2. Locations (where several similar items are used, provide a list)
 3. Systems and equipment controls including description of the sequence of operations and control diagrams.
 4. Performance curves and data
 5. Wiring diagrams
 6. Lubrication charts
 7. Manufacturers' recommended operating and maintenance instructions, with all non-applicable information deleted
 8. List of spare parts recommended for normal service requirements
 9. Assembly and disassembly instructions with exploded view Drawings, where necessary.
 10. Start-up procedures
 11. Routine and normal operating instructions
 12. Normal and emergency shutdown instructions
 13. Trouble shooting diagnostic instructions, where applicable

3.19 RECORD DRAWINGS

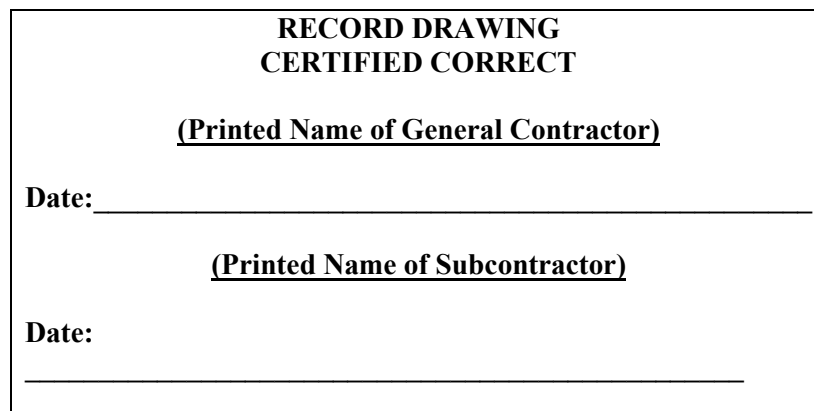
- A. The Contractor shall maintain on a daily basis at the project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of prints or AutoCAD REVIT files of the Contractor's Coordination Drawings. The prints shall be marked, or the AutoCAD REVIT files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded piping and valves, and all changes and deviations in the mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD REVIT electronic format media upon project completion.
- B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two (2) dimensions to permanent structures. Provide record drawings of the following items as a minimum:
1. Dimensional changes to Drawings.
 2. Revisions to details shown on Drawings.
 3. Locations and depths of underground utilities.
 4. Revisions to routing of piping and conduits.
 5. Actual equipment locations.
 6. Duct size and routing.

7. Locations of concealed internal utilities.
8. Changes made by Change Order.
9. Field records for concealed conditions.
10. Record information on the Work that is shown only schematically in the contract documents.

- C. The Contractor and subcontractor shall mark all in-progress Record Drawings on the front lower right-hand corner with a rubber stamp impression or an AutoCAD REVIT image similar to the following:



- D. Upon completion of the work, the Contractor and subcontractors shall certify all Record Drawings on the front lower right-hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD REVIT image similar to the following:



- E. Prior to final acceptance of the work of this Division, the Contractor shall submit properly certified Record Drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the Record Drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD REVIT format. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.
- F. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. After review, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 4. Architect will provide data file layer information. Record markups in separate layers.

3.20 CERTIFICATION

- A. Any certifications required by the Specifications, in addition to those required for shop drawings, product data, equipment and other items, are to be so certified in writing by the Owner, a Partner, or a Corporate Officer of the firm required to provide the Certification, or by another person duly authorized to sign binding agreements for and on behalf of the Owner, Partner or Corporation.

3.21 FINAL REVIEW

- A. At a time designated by the Owner, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.
- B. Demonstrate to the Owner and/or the Architect's personnel prior to the Final Review that systems and equipment have been properly balanced and adjusted and are in compliance with the requirements of the Contract Documents. After these demonstration tests are satisfactorily completed, but prior to the Final Review, submit a written certification that attests to the Contract Document compliance for this project
- C. Prior to the final review, the Contractor shall confirm the following items regarding the status of key elements of the work. Negative responses to any of the items indicate that the construction is not substantially complete, and the building is not ready for a final review. The Contractor shall confirm the following in writing:
 - 1. Building air systems (fans, air handling units, etc.) are completely installed, commissioned and operating.
 - 2. Building refrigerant systems are completely installed, commissioned, operating and pressure tested.
 - 3. Controls system is installed, commissioned and operating.
 - 4. Building has normal electrical power.
 - 5. Building systems have been cleaned.
 - 6. Seismic restraints have been inspected as specified. Any required special inspections have been completed.
 - 7. Building systems have been balanced and copy of balance report submitted to the Architect.
 - 8. Building fire and life safety systems have been tested and accepted by the local authorities. Any required special inspections have been completed.
 - 9. There are no deviations or non-compliance with the Contract Documents; otherwise, provide a detailed account of any and all deviations or noncompliance.
 - 10. All items on field review reports have been responded to in writing and are resolved to the satisfaction of the Owner.
 - 11. All outstanding items on submittals and shop drawings have been addressed in writing and are resolved to the satisfaction of the Owner.
 - 12. Schedule the final review only after providing written confirmation of all items above. Provide a minimum of ten (10) days' notice.
- D. Operate the entire system properly with all systems balanced and all controls adjusted.
- E. Certificates and Documents required by the Contract shall be presented to the Architect at least two (2) weeks prior to the Final Review.
- F. After the Final Review, any changes or corrections noted as necessary for the work to comply with the Contract Documents shall be accomplished without delay in order to secure final acceptance of the work.

3.22 EARLY OCCUPANCY

- A. Be responsible for completing those systems, which are necessary to allow partial occupancy of the building even if systems in the unoccupied areas are incomplete.
- B. Verify and comply with requirements for temporary occupancy with the local Building Department.

END OF SECTION 23 05 01

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include, but is not limited to the following:
 - 1. Pipe, duct and un-isolated equipment hangers, anchors and supports.
 - 2. Sleeves, escutcheons.
 - 3. Through-penetration firestopping in fire-rated construction and through penetration Smoke stopping in smoke partitions, including methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 05 48 – Vibration and Seismic Controls for HVAC
- C. Section 23 07 00 – HVAC Insulation
- D. Section 23 21 13 – Hydronic Piping
- E. Section 23 31 13 – HVAC Ducts and Casings

1.3 REFERENCE STANDARDS

- A. ANSI – American National Standards Institute
 - 1. ASME B31.9 – Standards of Pressure Piping – Building Services Piping
- B. ASME – American Society of Mechanical Engineers
 - 1. ASME B16.19 Factory-Made Wrought Butt-Welding Fittings
- C. ASTM – American Society for Testing and Materials
 - 1. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. ASTM B695 Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
 - 3. ASTM C1107/C1107M Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 4. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems
- D. ISO – International Organization for Standardization
 - 1. ISO 9001 Quality Management System Requirements
- E. MSS – Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
 - 1. SP-58 Pipe Hangers and Supports – Materials, Design and Manufacturer
 - 2. SP-69 Pipe Hangers and Supports – Selection and Application
 - 3. SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices
- F. UL – Underwriters Laboratories Inc.
 - 1. UL Standard 1479 Fire Tests of Through-Penetration Firestops
 - 2. UL Fire Resistance Fire Resistance Directory set
 - a. Through-penetration firestop devices (UL-XHCR)
 - b. Fire resistance ratings (UL-BXUV)
 - c. Through-penetration firestop systems (UL-XHEZ)
 - d. Fill, void, or cavity material (UL-XHHW)
 - 3. UL Building Materials Building Materials Directory
 - 4. UL Component Listing Test Criteria
 - 5. Warnock Hersey Mark (Certification of Building Products)
- G. California Building Code
- H. California Fire Code
- I. SMACNA HVAC Metal Duct Standards.

1.4 QUALITY ASSURANCE

- A. Hangers and supports to be constructed and applied according to the following standards:
1. Power Piping: ASME B31.9 – Standards of Pressure Piping – Building Services Piping
 2. Duct Hangers: Provide hangers as required per SMACNA Standards for ductwork pressure classification.
 3. Firestopping materials shall have been tested to provide fire rating at least equal to that of the construction.
 4. Deliver products in original, unopened packaging with legible manufacturer's identification.
 5. Mechanical sleeve seals shall be manufactured in an ISO 9001 certified facility.
 6. Submit written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

1.5 SUBMITTALS

- A. Include on ductwork and piping shop drawings a layout of masonry and concrete floor and wall sleeve locations for pipes and ducts. Include elevations and sleeve sizes.
- B. Submit product data on through-penetration firestop. Submittal data for firestopping systems shall include the UL System Numbers listed in the UL Building Materials Directory under which the material was tested in accordance with ASTM E814 (UL 1479) for use in a Through-Penetration Firestop System. Where there is a firestop application that has not been tested by UL, obtain from the manufacturer an engineered judgment that the proposed application of the firestop product is suitable. Submit the engineered judgment to the Authority Having Jurisdiction.
1. Product Data: Manufacturer's specifications and technical data including detailed specification of construction and fabrication, manufacturer's installation instructions and details of each proposed assembly identifying intended products and applicable UL system number or UL classified devices.
 2. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements:
 - a. Manufacturer or manufacturer's representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.
- C. Submit details of hangers, anchors and supports for each pipe size and service, ductwork and individual pieces of equipment.
- D. Submit joint sealer guarantee as described in sub-Clause 1.04, A.6.
- E. Submit load calculations for multiple or trapeze pipe hangers as required in Clauses 2.02, B. and 3.01, S.
- F. Submit ICBO Evaluation Reports as required in Clause 3.01, D.
- G. Submit shop drawings indicating support methods, point loadings, etc. as described in Clause 3.01, E.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe Hangers: Anvil, Fee & Mason, Elcen, Tube-Turn, F&S, Pipe Shields, B-Line Kindorf, Michigan Hanger, Power Strut, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by specified manufacturers is acceptable.
- B. Sleeves: Pipe Shields, Insul, RK Industries
- C. Pipe Wrap Tape: Polycen, Nassua, 3M
- D. Firestop: Nelson, Dow, 3M, Hilti
- E. Escutcheon Plates: Beaton & Corbin Manufacturing

- F. Mechanical Sleeve Seals: Pipeline Seal and Insulator, Thunderline Linkseal, Calpico Pipe Linx, Metraflex Metraseal

2.2 GENERAL

- A. Provide hangers of heavy construction suitable for the size of pipe to be supported. Materials shall be of steel, except pipe rolls of wrought or malleable iron.
1. Hangers for pipes eight-inches or less shall be swivel ring, wrought pipe clamp, or adjustable wrought clevis type. Anvil Figure 260, MSS-SP-69, Type 1.
 2. Hangers for ductile iron or cast-iron pipes four-inches or less shall be swivel ring, wrought pipe clamp or adjustable wrought clevis type. Anvil Figure 590, MSS-SP-69, Type 1.
 3. Hangers for pipes ten-inches and above shall have two rods and cross-rod with cast iron pipe roll complete with adjustable sockets and nuts. Anvil Figure 177, MSS-SP-69, Type 41.
 4. When an oversized clevis type hanger is used (i.e., insulate pipe) a pipe spacer shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt.
- B. Multiple or trapeze pipe hangers shall be steel channels with welded spacers and hanger rods if hanger load calculations are submitted.
- C. Wall support shall be welded steel bracket with hanger

Light Duty Wall Support:	Anvil Figure 194, MSS-SP-69, Type 31.
Medium Duty Wall Support:	Anvil Figure 195, MSS-SP-69, Type 32.
Heavy Duty Wall Support:	Anvil Figure 199, MSS-SP-69, Type 33.

- D. Metal Framing Channels:
1. Provide perforated electro-galvanized finish, 12-gauge minimum steel channels securely anchored to wall structure with interlocking, split type, bolt-secured, galvanized pipe/tubing clamps. B-Line type B22, S pattern with B-2000 series clamps, Power-Strut Type PS200 H with PS1200 clamps or equal.
 2. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion, or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Power-Strut PS004T – PS106N Series or equal.
- E. Support stationary vertical piping with carbon steel double bolt riser clamps attached to the pipe. Weld shear lugs to the pipe. In general, use one clamp for each two floors and one clamp at each floor for copper tubing. Where pipes are in open shafts, provide forged steel bar brackets fixed to wall. Riser clamps shall be copper plated when used with copper pipe. Locate riser clamp immediately under coupling or other fitting. Anvil Figure 261, MSS-SP-69, Type 8 for steel pipe; Anvil Figure CT121, MSS-SP-69, Type 8 for copper pipe.
- F. Floor Support for Pipe:
1. Sizes up to 4 inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support. Anvil Figure 264, MSS-SP-69, Type 38.
 2. Sizes 5 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support. Anvil Figure 265, MSS-SP-69, Type 38.
 3. Provide pipe stanchions for support of pipe elbows at base of riser and vertical piping. Stanchions shall be complete with base plate and vent hole. Anvil Figures 62 and 63.
- G. Select hangers and supports in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- H. Hangers shall not be disengaged by movement of supported pipe.
- I. Provide copper-plated or felt-lined hangers for copper piping or provide 10-mil pipe wrap tape on pipe at hangers. Tape shall extend a minimum of 2 inches beyond hanger saddle on both ends and be wrapped around pipe a minimum of 2 turns. Install vinyl coated hangers for all plastic piping.
- J. Steel hanger rods shall be threaded both ends, threaded one end, or continuous threaded, black finish. Provide rods complete with adjusting and lock nuts. Anvil Figures 146, 140 or 253.
- K. Pipe Support Recommendations for Rigid Grooved Joint Systems: The maximum hanger spacing in the specification to ANSI/ASME B31.1 as noted and should be used only in conjunction with Victaulic 07

zero-flex rigid couplings. For flexible systems the hanger, support, spacing and location refer to the pipe support recommendations section in the Victaulic "Field Assembly and Installation Pocket Handbook" or equivalent provided by Grooved Joint Manufacturer.

L. Beam Clamps:

1. Provide MSS-SP-69 Type 23 malleable black iron clamp for attachment to beam flange up to 0.62 inches thick for single threaded rods of $\frac{3}{8}$ -, $\frac{1}{2}$ -, and $\frac{5}{8}$ -inch diameter, for use with pipe sizes 4-inch and less. Furnish with a hardened steel cup point set screw. Anvil Figure 86.
2. Provide MSS-SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes up to 1.5-inch diameter but limited in application to pipe sizes 8-inch and less without prior approval. Anvil Figure 228.

M. Continuous Concrete Insert Channels:

1. Provide steel inserts with industry standard pre-galvanized finish, nominally $1\frac{5}{8}$ -inch wide by $1\frac{3}{8}$ -inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices.
2. Installed channels shall provide a load rating of 2,000 pounds per foot in concrete. Manufacturer's standard brackets, inserts, and accessories designed for use with continuous concrete inserts are acceptable.
3. Select insert length to accommodate all pipe, duct, and conduit in the area.

N. Anchors shall be fabricated using welding steel shapes, plates, and bars to secure piping to the structure.

O. Concrete inserts shall be MSS-SP-69 Type 18 wedge type or universal concrete inserts.

1. Wedge type shall be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to $\frac{7}{8}$ -inch diameter. Wedge design shall allow the insert to be held by concrete in compression to maximize the load carrying capacity. Anvil Figure 281.
2. Universal type shall be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to $\frac{7}{8}$ -inch diameter. Anvil Figure 282.
3. Use drilled steel shell with plug type inserts when the inserts are placed after the concrete is poured.

P. Drainage Piping: Provide MSS-SP-69 Type 8 or MSS-SP-69 Type 42 riser clamps for vertical piping, and MSS-SP-69 Type 52, spring hangers at the base of vertical piping.

2.3 SLEEVES

- A. Construct sleeves for pipes passing through walls (other than foundation walls), floors, partitions, hung or furred ceilings, etc., of minimum 18-gauge galvanized steel, flanged on each side of wall, partition, hung or furred ceiling, etc.
- B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.
- C. Provide 20-gauge galvanized sheet metal sleeves, the full depth of floor or wall, for round ductwork passing through masonry or concrete and/or steel cellular floor construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.
- D. Provide cast iron or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Stack Sleeve Fittings: Provide manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing and underdeck clamping ring with setscrews.
- F. Provide mechanical sleeve seals at exterior wall and tank wall penetrations. Seal shall be of the modular sealing element unit type, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Sealing Elements: [EPDM] [Nitrile] [Silicone] interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: [Plastic] [Carbon steel with corrosion-resistant coating]. Include two for each sealing element.
 3. Connecting Bolts and Nuts: [Carbon steel with corrosion-resistant coating] [Stainless steel] of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- G. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations. Provide manufactured wall and ceiling

escutcheons and floor plates, with an inside diameter to closely fit around pipe, tube, and insulation of insulated piping and an outside diameter that completely covers opening. Escutcheons shall be cast iron or cast brass, deep-pattern escutcheons if required to conceal protruding fittings, sleeve hubs or firestopping projections.

2.4 PENETRATION FIRESTOP

- A. Fire-Rated Construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, and sound or vibration absorption, and at other construction gaps.
- B. Smoke Barrier Construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.
- C. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free. Mortar systems must be Warnock Hersey approved.
- D. Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.
- E. All firestopping products must be from a single manufacturer.
- F. Through-penetration smokestopping at smoke partitions: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded in a non-fire rated smoke barrier.
- G. Seal all pipe and duct penetrations through fire-rated construction with factory-built devices or with manufactured fill, void, or cavity materials "Classified" by Underwriters Laboratories Inc. for use as a Through-Penetration Firestop. All firestop devices and systems shall be approved for such use by the Authority Having Jurisdiction. The firesafing system used shall maintain the fire-resistance rating of the building component that is penetrated.
- H. All materials shall be non-hardening and non-toxic. The firesafing system used shall accommodate expansion and contraction of the floating mechanical piping systems without damaging the firestop or reducing its effectiveness as a smoke barrier or water seal.

2.5 GROUT

- A. Grout shall be slow-hardening after application, volume-adjusting, non-staining, noncorrosive, non-gaseous, and recommended for interior and exterior applications.
- B. Provide ASTM C1107/C1107M, Grade B, non-shrink and non-metallic, dry hydraulic cement grout.
- C. Design Mix: 5,000 psi, 28-day compressive strength from a premixed and factory prepackage.

PART 3 – EXECUTION

3.1 HANGERS AND SUPPORTS

A. Deflection of pipes shall not exceed 1/240th (0.416 percent) of span.

1. Support horizontal steel/copper piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)		Hanger Rod Diameter (inches)	
	Steel	Copper	Steel	Copper
up to 1	7	5	$\frac{3}{8}$	$\frac{3}{8}$
1.25	9	7	$\frac{3}{8}$	$\frac{3}{8}$
1.5 & 2	9	8	$\frac{3}{8}$	$\frac{3}{8}$
2.5	12	9	0.5	0.5
3	12	10	0.5	0.5
3½	--	11	$\frac{5}{8}$	0.5
4	12	12	$\frac{5}{8}$	0.5
5	12	13	$\frac{5}{8}$	0.5
6	12	14	0.75	$\frac{5}{8}$
8 & 12	12	14	$\frac{7}{8}$	0.75
14 & 16	12	--	1	--
18 & 20	12	--	1.25	--
24	12	--	1.5	--

2. Support horizontal plastic piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)					Hanger Rod Diameter (inches)
	CPVC	PVC	PP	PVDF	FG	
up to 1	3.5	3	2.75	2.5	0	$\frac{3}{8}$
1.25	3.5	3	2.75	3	10	$\frac{3}{8}$
1.5 & 2	3.5	3.5	2.75	3	10	$\frac{3}{8}$
2.5	3.5	3.5	3.5	3.5	10	0.5
3	3.5	3.5	3.5	3.5	10	0.5
3½	--	--	--	--	--	--
4	4	4	4	4	10	$\frac{5}{8}$
5	4	4	4	4	10	$\frac{5}{8}$
6	4	4	4	4	10	0.75
8 & 12	--	4	4	--	12	$\frac{7}{8}$
(C)PVC: (Chlorinated) Polyvinyl Chloride Plastic; PP: Polypropylene plastic; PVDF: Polyvinylidene Fluoride Plastic; FG: Fiberglass						

- B. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item. Provide hanger on both sides of “no-hub” mechanical joints.
- C. Support hangers from concrete inserts or beam clamps. Furnish, locate and set inserts. Construct inserts of malleable iron or pressed steel with space for rods of all sizes. Install inserts for pipes 3 inches and larger in size with a reinforcing rod $\frac{5}{8}$ -inch in diameter run through a slot in the insert specifically provided for this purpose.
- D. If piping is required in a space where no inserts have been provided, drill holes in the slab (subject to

Structural Engineer's prior approval) and provide rods and hanger attached to an approved fishplate or install double expansion shields connected by a 2-inch by 2-inch angle, from which the hanger rod is to be suspended. For pipe size 2 inches and under use single shields but the hanger spacing shall be reduced to 5 feet. The carrying capacity and size of each shield shall be calculated on the basis of the spacing indicated above but the minimum size shall be $\frac{3}{8}$ -inch. Install additional shields of the same size so that the number of hangers is of adequate size to support the loads, which they carry. Shields may be used in concrete slabs only. Obtain from the expansion shield manufacturer an ICBO Evaluation Report for the product and submit to the Architect.

- E. Regardless of the type of construction (i.e., concrete, concrete-deck-steel or other variations) take particular care to support main lines and large and heavy pipes in an approved manner, including the provision of supplementary steel, if required. Supplementary steel shall be mill-rolled sections. Submit shop drawings, indicating support methods, point loadings to the building structure and hanger locations for review sufficiently in advance of concrete pouring schedules to permit evaluation, critique and any necessary changes to handling and support methods.
- F. Hangers shall be directly bolted to steel beams of building construction, where they occur if approved by the Structural Engineer. Smaller pipes shall be suspended from crosspieces of pipe or steel angles, which in turn, are securely fastened to building beams or hung from building concrete construction by means of rods and inserts. The intention is to provide supports which shall be amply strong and rigid for the load, but which will not weaken or unduly stress the building construction.
- G. Attachments to existing steel deck shall be limited to loads of 500 pounds. Heavier loads shall be supported by supplementary structural steel connected to structural beams. Provide all required supplementary steel.
 - 1. Attachments with loads up to 500 pounds shall be accomplished by drilled-in expansion shield type anchors located on the centerline of the concrete-filled ribs.
 - 2. No attachments shall be permitted to new or existing electrified decks. If hanger attachments are not existing, all new attachments shall be supported from supplementary steel.
 - 3. 500-pound load attachments shall be spaced not less than 60 inches apart, and shall be located as close to steel beams as possible.
- H. Provide approved roller support, floor stands, wall brackets, etc., for lines running near the floor or near walls, which can be properly supported or suspended by the floors or walls. Pipelines near walls may also be hung by hangers carried from approved wall brackets at a higher level than the pipe.
- I. Do not hang piping or ductwork from supports for other services. Installed supports shall accommodate free expansion of the piping and duct system.
- J. Wherever hangers using pipe rolls are used, provide approved steel pipe covering protection saddles, spot-welded to the piping at each hanger location.
- K. Anchor piping where shown to localize expansion or to prevent undue strain on piping and branches. Anchors shall be entirely separate from hangers and of heavy forged or welded construction of approved design. All anchor designs, when submitted for approval, shall include piping reactions which respective anchors are capable of supporting. Provide indicated expansion loop.
- L. Install anchors where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
- M. Support copper tubing individually by approved hangers not more than 6 feet apart. Hangers for uncovered lines shall be specially designed for copper tubing and of exact outside diameter of tubing. Hangers for covered tubing shall be broad straps fitting outside of covering.
- N. Hangers for insulated piping shall support the pipe without piercing the insulation. Refer to Section 23 07 00 – HVAC Insulation for insulation protection shields and pipe inserts.
- O. For piping 4 inches and larger, support the elbows of the piping adjacent to pumps with steel supports from the concrete housekeeping pad, or from the inertia base where pump is mounted to prevent loading heavy weights of piping on pump flanges or casing. Where inertia base or spring vibration isolation is not provided, base elbows shall be supported on concrete pad with 1-inch neoprene pad.
- P. Use hangers, which are vertically adjustable 1.5-inch minimum after piping is erected. Install hangers so that $\frac{1}{2}$ -inch minimum clearance is maintained between finished covering of pipe and adjacent work.
- Q. Support riser piping independently of connected horizontal piping.
- R. Adjust hangers to obtain pipe slope where specified.

- S. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior review.
- T. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.
- U. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123/A123M, 1.5-ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes shall be field-covered with zinc-rich paint of comparable thickness to factory coating. Corrosive atmospheres include the following locations:
 - 1. Exterior locations, parking ramps, carwash areas
 - 2. Swimming pool equipment, chemical storage or hazardous waste storage rooms
 - 3. Wet wells, meter pits
 - 4. Sanitary and storm sewer pumping stations
 - 5. Food service/kitchen areas, walk-in coolers/freezers
 - 6. Locker/shower rooms
 - 7. Greenhouses

3.2 SLEEVES

- A. Provide sleeves for pipe passing through floors, walls or partitions, hung or furred ceilings, of sufficient diameter to accommodate pipe covering where such is required. Locate sleeves secure in place so that an equal space is around the pipe, after the pipe is installed.
- B. For sleeves at penetrations of metal deck, nail, screw or weld to the deck prior to the pouring of the deck concrete. Set sleeves in such a manner so that no concrete fills their interior during the concrete pouring and finishing operations.
- C. For exposed pipes, caulk floor sleeves with firestop material watertight and project sleeve approximately 2 inches above the finished floor. Finish sleeves with specified flanges flush with the bottom of slab and also with the finished faces of wall.
- D. Provide sleeves with an inside diameter at least ½-inch greater than outside of pipe served, including pipe insulation which must be continuous through sleeve.
- E. Where piping penetrates walls (other than foundation walls), partitions, floor slabs, etc., pack space between piping and sleeve with mineral wool (for depth of sleeve), or firestop material.
- F. Do not support pipes by resting clamps on sleeves. Clamps shall extend beyond sleeve and be supported outboard of sleeve in an approved manner. In no case shall sleeves be cut or slotted to accommodate pipe clamps.
- G. Provide escutcheon plates of the proper size for piping in sleeves passing through floors, walls, soffits, furrings, partitions, hung ceilings, etc., throughout the building where exposed. Exposed escutcheons shall be cast brass chromium plated, bell type, with setscrews of sufficient diameter to include any required pipe insulation. Attach escutcheon to building material, not to pipe. Do not penetrate vapor barriers.
 - 1. Split-casting, deep-pattern type cast-brass type with concealed hinge and set screw with polished chrome-plated and rough brass finish.
 - 2. Split-casting, floor-plate type cast brass with concealed hinge and set screw.
- H. Exterior-wall pipe penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install aboveground steel pipe for sleeves smaller than 6 inches.
 - 2. Install aboveground cast-iron "wall pipes" for sleeves 6 inches and larger.
 - 3. Install underground cast-iron "wall pipes" for all sleeves.
 - 4. Mechanical Sleeve Seal Installation:
 - a. Select type and number of sealing elements required for pipe material and size.
 - b. Position pipe in center of sleeve.

- c. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve.
- d. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- e. For wall thickness up to 12 inches provide one mechanical sleeve seal at the interior side of sleeve, for wall thickness greater than 12 inches provide two mechanical sleeve seals, one at the interior side of sleeve and one at the exterior side of sleeve.

3.3 FIRESTOPPING

- A. Where space for future ducts, pipes and conduits is required, provide sleeves and fill with lightweight concrete or firestop.
- B. Provide firestopping and grouting around pipes and ducts penetrating concrete slabs, concrete walls and masonry walls with cement grout in the sleeved opening extending full depth through wall or floor slab. Provide sheet metal cover over the insulation before applying grout. Around pipes and ducts through fire rated gypsum board construction, pack the annular space between the wall sleeve and the insulation sheet metal cover with noncombustible approved firestop material and finish with 20-gauge sheet metal collar on ducts and escutcheons on pipe where duct or pipework is exposed. Attach escutcheons to wall.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- D. Environmental Requirements:
 - 1. Provide adequate ventilation if using solvent.
 - 2. Provide forced-air ventilation during installation if required by manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
 - 5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- E. Clean surfaces that will be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.
- F. Install penetration seal materials in accordance with the UL Fire Resistance Directory or Mortars per Warnock Hersey approval and in accordance with manufacturer's instruction.
- G. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- H. Where large openings are created in walls or floors to permit installation of pipes, ducts or other items, close unused portions of opening with firestopping material tested for the application. See UL Fire Resistance Directory or Warnock Hersey approvals.
- I. Install smoke stopping as specified for firestopping

3.4 GROUTING

- A. Mix, install and cure grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout.
- C. Place grout, completely filling equipment bases.
- D. Place grout on concrete bases and provide smooth bearing surface for equipment.
- E. Place grout around anchors.

END OF SECTION 23 05 29

SECTION 23 05 53 – MECHANICAL SYSTEMS IDENTIFICATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work on this section shall include, but is not limited to the following items:
 - a. Equipment identification
 - b. Pipe identification.
 - c. Valves, dampers, fire dampers, smoke dampers and combination fire/smoke dampers, and automatic control dampers identifications.
 - d. Duct work identification.
 - e. Bar coding new equipment and components
 - f. Warning signs and labels

1.2 RELATED DOCUMENTS

- A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Mechanical Contractor, all sub-contractors, and all material suppliers.
- B. Section 23 05 01 – HVAC General Provisions
- C. Section 23 05 50 – Access Doors

1.3 CODES AND REFERENCE STANDARDS

- A. ASME – American Society of Mechanical Engineers
 - a. ASME A13.1 Scheme for the Identification of Piping systems
- B. ASTM – American Society for Testing and materials
 - a. ASTM D709 Standard Specification for Laminated Thermosetting Materials.
- C. APWA – American Public Works Association
 - a. Recommended Guidelines for Underground Utilities

1.4 QUALITY ASSURANCE

Provide work in strict accordance with Federal, State, County and City laws, codes, rules and regulations, as well as those of other regulatory agencies having jurisdiction. Specifications or drawings are not to be construed to permit anything contrary to above requirements.

1.5 SUMMITTALS

- A. Submit product data for each type of product indicated.
 - a. Lists of all pipe and equipment labeled.
 - b. Color chart.
 - c. Valve identification chart.
 - d. Damper identification chart for all kinds of dampers such as fire, smoke and combination fire and smoke dampers.
 - e. Manufacturer's published data for materials, equipment, installation, maintenance including samples tags, equipment identification and pipe identification.
 - f. Provide valve and damper tag schedules for inclusion in maintenance manuals.

1.6 PERFORMACE REQUIREMENT

- A. All equipment and part Identification shall meet or exceed the performance requirements specified.
- B. Low Emitting Materials, Adhesives and Sealants (LEED Credit if Required but recommended regardless of credit).
- C. Low Emitting Materials, Paints and Coatings (LEED Credit if required but recommended regardless of credit).

1.7 ENVIRONMENTAL OBJECTIVES

- A. Meet LEED requirement if part of the requirement is required for this project.

1.8 LEED SUBMITTALS

- A. Submit all documentation required by Sustainable Design and LEED requirements such as adhesives, sealants, paints, and coatings if required for this project.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Kolbi
- B. Seton
- C. Stranco

2.2 VALVE AND DAMPER IDENTIFICATION

- A. All tagged components shall be in accordance with ASME A13.1.
- B. For valves, and all dampers including smoke and combination fire/smoke dampers and automatic control dampers, use metal tags 2-inch minimum diameter, fabricated of 19-gauge polished brass, stainless steel or aluminum.
 - a. Attach tags with jack chain “S”-hook or split ring of same materials.
 - b. Provide engraved/stamped tags with black ink-filled ¼-inch high letters and ½-inch high numbers.
 - c. Provide minimum 5/32-inch hole for fastener.

2.3 PIPE IDENTIFICATION

- A. Pipe markers shall have 1.25-inch-high letters and integral directional flow arrows.
 - a. Smaller letters may be used only when space does not permit 1.25-inch-high lettering.
- B. For piping up to 5-inch diameter, use pre-formed Snap-On markers.
- C. For piping 6-inch diameter and larger, use pre-formed strap-on markers with nylon straps.
- D. Material: Semi-rigid colored vinyl; 15 gauge up to 1-inch pipe, 30 gauge for all other pipe sizes.
- E. Use Seton “Setmark” or equal.
- F. Pressure-sensitive tapes shall not be used and are unacceptable.
- G. For Exterior Underground Pipe Markers:
 - a. Material shall be detectable tape, nominal 5-mil thick, minimum 3 inches wide with aluminum backing.
 - b. Tape color, size and depth to be in accordance with APWA standards with black lettering and appropriate warning message.

2.4 EQUIPMENT IDENTIFICATION

- A. Mechanical equipment shall be identified by means of nameplates permanently screw-fastened to the equipment. Nameplates shall be black surface, white core laminated Bakelite with engraved letters. Plates shall be a minimum of 3-inch long by 1-inch wide with white letters ⅜-inch high.
- B. Terminal equipment installed in ceiling spaces such as variable volume terminals, fan coil units, heat pumps, etc., shall have identifying number stenciled on bottom of unit so that it is visible from below.

2.5 SIGNAGE

- A. Provide engraving stock melamine plastic laminate, complying with ASTM D709, in sizes and thicknesses indicated, engraved with engraver’s standard letter style of sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - a. Thickness: 1/16-inch for signs up to 20 square inches or 8-inch length; ⅛-inch for larger signs.
 - b. Fasteners: Self-tapping stainless-steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

PART 3 – EXECUTION

3.1 VALVE AND AUTOMATIC DAMPER IDENTIFICATION

- A. Do not identify valves where the use is obvious, such as equipment isolation valves.
- B. Provide schedules of all valves showing identification number, size, type and service of each valve. Provide separate list for each separate type of system. Incorporate in maintenance manuals.
- C. Tag automatic dampers including smoke and combination fire/smoke dampers with identical letters or numbers as shown on the Drawings.

3.2 EQUIPMENT IDENTIFICATION

- A. Identify equipment with identical letter and/or number as used on the Drawings. Where space is available, use full name of equipment. Attach nameplates in a permanent manner in a location that will be clearly visible after installation is complete.
- B. Identify controls such as, alarms, remote push-button switches with ¼-inch high lettering and laminated plastic plates screwed or chained to equipment.

3.3 PIPING IDENTIFICATION

- A. Piping identification shall be in conformance with the ASME A13.1
- B. Identify piping systems with color-coded bands, sharply contrasting with background. Locate bands near strategic points, such as valves, items of equipment, changes in direction, wall penetrations, capped stub-out for future connection and every 40 feet of straight runs. If necessary, paint a strip background of black or white to obtain contrast.
- C. Apply bands where they can be easily read. Provide bands with backgrounds of different Colors.
- D. Drain piping serving mechanical equipment items for which the drain discharge is not visible from the equipment shall be marked near the point of discharge indicating the item of equipment served.

3.4 ACCESS IDENTIFICATION

- A. Identify service, damper, duct access door, piping and equipment behind all architectural access doors.
- B. Removable ceiling tile shall be marked by small color markings at corner of tile or door in accordance with the following color assignments:

HVAC Cooling	Green
HVAC Heating	Yellow
HVAC Heating/Cooling	Yellow/Green
HVAC (other)	Blue

3.5 INSTALLATION OF IDENTIFICATION

- A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.6 UNDERGROUND PIPING IDENTIFICATION

- A. During backfilling/topsoil of each exterior underground piping system, install continuous detectable underground type plastic line marker, located directly over, buried in accordance with APWA standards.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include, but is not limited to, the following:
 - 1. Adjust and balance hydronic systems.
 - 2. Adjust and balance air systems.
 - 3. Perform acoustic measurements to systems.
 - 4. Perform airflow measurements for smoke control system zones and stair and vestibule pressurization tests.

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 09 13 – Sequence of Operations for HVAC Controls
- C. Section 23 05 00 – Dampers
- D. Section 23 05 – HVAC Fans
- E. Section 23 37 00 – Air Outlets and Inlets

1.3 REFERENCE STANDARDS

- A. All work shall be in accordance with the Associated Air Balance Council Standards.

1.4 QUALITY ASSURANCE

- A. Each Balancing Contractor providing a bid for this work shall submit the following information with the bid, or the bid shall not be accepted by the Owner:
 - 1. List previous projects of similar scope with dates that projects were executed.
 - 2. Outline organization of Contractor, including names of principals, years of operation, address, and phone number.
 - 3. List instruments owned by Contractor and procedures that will be used on this project.
 - 4. List name of job site supervisor that will execute this work and a résumé of individual's specific work experience.
 - 5. Provide a sample of a balance report on a project of similar scope.
- B. The final balancing, testing, and adjustments of the complete mechanical systems shall be the direct responsibility of the Balancing Contractor, including all costs for doing this work and provision of the personnel, materials, tools, and instrumentation to accomplish this work. Meet standards contained in the AABC National Standard Chapter 17 through 26 and other criteria as set forth in these specifications.
- C. The Contractor must primarily be engaged in the balancing and testing of heating, ventilating and air conditioning systems. The Contractor must be AABC certified.

1.5 SUBMITTALS

- A. Three months prior to the start of the Test and Balance field activities, submit certification of most recent calibration of all instruments to be used on this project.
- B. Submit project-specific agenda (outline) as described below.
- C. Submit sample forms as described below.
- D. Submit Balancing Report as described in Paragraph 3.04.

1.6 PROCEDURES

- A. General: Prior to commencement of balancing, review proposed schedule, methods and instruments to be used in balancing with the Architect. Include descriptive data, procedure data and sample forms.
- B. Descriptive Data: Review Contract Documents, shop drawings released for construction, design concepts and general function of each system including associated equipment and operation cycles. Confirm listing of flow and terminal measurements to be performed; selection points for proposed sound measurements.
- C. Procedure Data: Outline procedures for taking test measurements to establish compliance with requirements. Specify type of instruments to be used, method of instrument application (by sketch) and correction factors. Verify access to valves, dampers and equipment for test and balancing.

- D. Sample Forms: Submit forms showing application of procedures to typical systems. Forms shall be of AABC format.
- E. AABC test sheets required are as follows:
 - 1. Air Moving Equipment Test Sheet
 - 2. Exhaust Fan Test Sheet
 - i. Supply
 - ii. Return
 - iii. Relief Fans
 - 3. Air Inlet and Outlet Test Sheet
 - 4. Water Balance Element Test Sheet
 - 5. Circulating Water Pump Data Sheet
 - 6. Duct Traverse Zone Totals Sheet
 - 7. Duct Traverse Readings Sheet

1.7 CONTRACTOR COOPERATION

- A. The Balancing Contractor shall check and report defects or deficiencies that may affect balancing.
 - 1. Mechanical Contractor shall cooperate with the Balancing Contractor to:
 - a. Provide sufficient time before final completion date and individual equipment manufacturer's start-up so that balancing can be accomplished.
 - b. Provide immediate materials, labor and tools to make corrections without delay.
 - c. Place heating, ventilating and air-conditioning systems and equipment into full operation and continue the operation for each working day of testing and balancing.
 - d. Advise Testing and Balancing Contractor of changes made to the system during construction.
 - e. Install required test holes or wells complete with removable and replaceable plugs or caps.
 - f. Make necessary revisions to controls, valves, dampers, fan and pump drives and consult with equipment manufacturers as required to achieve the specified system's performance.
 - g. Supply and install dampers as specified and shown on the Drawings, and where required to obtain final system balance.
 - h. Provide lifts, ladders, scaffolds, tools and labor to assist the work of the Balancing Contractor, including removing ceiling tiles, guards, adjusting pulleys, belts; replace when finished.
 - i. Building Management System Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls that are not properly calibrated.
 - j. Set pressure-regulating and -reducing valves to operating and code conditions.
 - k. Check and set relief and safety valves to code requirements.
 - l. Clean strainers. Check air filters immediately prior to air balancing.
 - m. Open fire dampers. Provide certification of damper operation as required by Section 23 05 00 – Dampers.
 - n. Verify return air openings have been provided in full height walls as specified, shown on the Drawings or as required for proper balancing and system operation.
 - o. Variable pitch sheaves supplied on 20-horsepower motors and larger shall be changed to fixed sheaves after the air balance is completed.
Provide such sheaves.

PART 2 – PRODUCTS

2.1 INSTRUMENTS

- A. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.
- B. Submit a list of equipment, which will be used for the balancing of systems and test and calibration certification by an independent instrument calibration laboratory indicating date of test, and test results showing accuracy and repeatability are within limitations acceptable to the AABC.

PART 3 – EXECUTION

3.1 GENERAL PROCEDURE

- A. Balance to maximum measured flow deviation from specified values of 10 percent at terminal device and 5 percent at equipment or mean sound-level deviation of 15 decibels.
- B. Permanently mark settings on valves, splitters, dampers and other adjustment devices.
- C. Take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Architect.
- E. At the completion of balancing procedures, allow for a minimum of 2 days for the Architect to witness test procedures and conduct operational tests.

3.2 SITE VISITS

- A. A review of the installation shall be made prior to commencing balancing work and any additional dampers or valves required for proper balance shall be reviewed with the Architect and the Contractor.
- B. The Test and Balance Contractor shall visit the job site a minimum of 3 times during the ductwork, equipment and piping installations. Site Visit Reports shall be submitted to the Architect listing any deficiencies found. Identify in the Report any additional balancing valves or dampers required.

3.3 ACCEPTANCE

- A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.
- B. If it is found that the specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action before continuing the balance procedure.
- C. If measured flow at final inspection shows deviation of 10 percent or more or mean sound-level deviation of 10 decibels or more from the certified report listings for more than 10 percent of selected areas, the Report shall be rejected.
- D. If Report is rejected, systems shall be rebalanced and a new certified report submitted.

3.4 BALANCING REPORT

- A. Submit a draft copy of reports prior to final acceptance of project. Provide copies of final report for inclusion in Operating and Maintenance Manuals.
- B. Provide reports in durable soft cover, 3-ring binder manuals, complete with table of contents, indexing tabs and cover identification at front and side.
- C. Include types, serial number and dates of calibration of instruments.
- D. Record test data on a sepia made from the latest available revised set of mechanical shop drawings and submit copies upon completion of the Balancing Contract.
- E. Install at each piece of mechanical equipment a “Data Register” showing significant operating temperatures, pressures, amperes, voltage, and brake horsepower. “Data Register” shall be enclosed in a hard, clear plastic holder securely attached to the equipment or to a wall in the adjacent area.
- F. Submit with Report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and diffusion factors.

G. Report shall be indexed as follows:

1. Air
 - a. Summary
 - b. Procedure
 - c. Instrumentation
 - d. Drawings
 - e. Equipment Summary
 - f. Door Blower Test Data
 - g. Fan Sheets
 - h. Fan Curves
 - i. Fan Profile Data
 - j. Static Data
 - k. Air Monitoring Station Data
 - l. Traverse Data and Schedule
 - m. Terminal Unit Summary
 - n. Outlet Data Summary and Schematics (per system)
 - o. Building Pressurization Data
 - p. Smoke Exhaust Mode Data
 - q. Stairway and Stair Vestibule Pressurization Data
 - r. Smoke Control System Testing (Smoke Control Zone Supply, Relief and Exhaust Capacities)
2. Sound
 - a. Summary
 - b. Procedure
 - c. Instrumentation
 - d. Drawings
 - e. Profile
 - f. Scale Readings
3. Fire Damper Certification
4. Copy of Contractor's Certification

3.5 DOOR BLOWER TEST PROCEDURE

- A. To be performed by license HERZ tester.
- B. The purpose of this procedure is to test a sample of the residential units to identify openings between adjacent residential units, where the potential for odor-migration is largely driven by tightness of construction rather than airflow and relative pressurization.
- C. Test a sample of one in seven mock-up units using a door blower apparatus. Place a door blower apparatus in the entry door of the condominium being tested, in addition to the units immediately above, below and to either side.
- D. The testing is to be conducted early in construction at a baseline value of 0.02" WG relative to the adjacent units above, below and horizontally adjacent.
- E. Provide feedback to the General Contractor, Mechanical Engineer and Architect in the form of a report that will help inform tightness of construction for the remainder of the project.

3.6 RESIDENTIAL UNIT TEST PROCEDURE

- A. Verify at all supply diffusers that proportional air is delivered
- B. Verify toilet exhaust fans are pre-set to the scheduled pick-a-flow volume for both constant minimum and high volume. Verify the fans draw exhaust air by placing a piece of paper under the air grille.
- C. Verify outside air fan delivers outside air and is cfm dial is set to the scheduled outside air volume.
- D. Verify both cooling and heating mode to ensure the system is performing as designed in both modes.
- E. Document and submit for record. Scanned hand-marked-up tables with check-boxes for each unit are acceptable for the residential units only. Recording of air outlet volume in cfm is not required.

3.7 AIR SYSTEM PROCEDURE

- A. Execute air systems balancing for each air system in accordance with AABC specifications and as described herein.
 - B. Make tests with supply, return and exhaust systems operating and doors, windows, closed or in their normal operation condition.
 - C. Test and adjust fan or blower speed to design requirements.
 - D. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.
 - E. Traverse main supply air ducts, using a pitot tube and manometer. Calibrate the manometer to read two significant figures in velocity pressure ranges. Take a minimum of 16 readings per traverse. The intent of this operation is to measure by traverse the total air quantity supplied by the fan and to verify the distribution of air to zones. A "main duct" is defined as any of the following:
 - 1. A duct serving 5 or more outlets.
 - 2. A duct serving 3 or more branch ducts.
 - 3. A duct emanating from a fan discharge or plenum and terminating at one or more outlets.
 - F. Submit data in support of supply fans deliveries by the following four methods. For return, relief and exhaust fans, methods 1 and 4 are sufficient:
 - 1. By summation of the air quantity readings at inlets or outlets.
 - 2. By duct traverses of main supply ducts.
 - 3. By rotating vane traverse across the filter bank or coil bank.
 - 4. By plotting revolutions per minute and static pressure readings on the fan curve.
- Air density corrections must be indicated.
- G. Test and record required and measured system static pressures; filter differential, coil differential and fan total static pressure.
 - H. Test and adjust systems for design recirculated airflow rates.
 - I. Test and adjust system for design outside airflow rates.
 - J. Test and record entering and leaving air temperatures.
 - K. Install one-inch roll media filters upstream of air filters to impose 90 percent of the manufacturer's recommended final filter air pressure drop.
 - L. Adjust main supply and return ducts to proper design flow rates.
 - M. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in their correct position, all duct access doors are closed and fire damper fusible links are accessible.
 - N. Adjust zones to proper design, supply and return flow rates.
 - O. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.
 - P. Identify each air inlet, air outlet, transfer duct and transfer wall opening as to location and area.
 - Q. Identify and list size, type and manufacturer of diffusers, grilles, registers and testing equipment. Use manufacturer's rating on equipment to make required calculations.
 - R. In readings and tests of diffusers, grilles and registers, report the required face and neck velocity, test face and neck velocity, and required air pressure drop and flow rate. Test after adjustments.
 - S. Building Management System Contractor shall set adjustments of automatically operated inlet vanes, cones, plugs and all dampers to operate as indicated in cooperation with Balancing Contractor.
 - T. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent "short circuiting" between supply and return outlets.
 - U. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters. Remove air slots on return air troffers to achieve adequate relief and minimize pressure drop into the ceiling plenum.
 - V. Vary total system airflow rates by adjustment of fan speeds or fan volume-varying devices. Vary branch air quantities by damper regulation.
 - W. Record installed fan drive assemblies; fan sheaves, motor sheaves, belts and motors.
 - X. For fans with two-speed motors, execute the entire air systems procedure at both speeds. This also applies to fans with variable frequency drives when used in normal mode and smoke control modes.
 - Y. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery

rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions.

Z. Document abnormal building leakage conditions noted.

AA. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.05-inch water gauge minimum and 0.10-inch water gauge maximum shall be achieved, measure with negligible, outside wind velocity.

BB. Complete balancing of the refrigeration machinery room intake and exhaust air systems to maintain a negative pressure of 0.05-inch water gauge minimum relative to adjacent spaces.

CC. Test stairway and stair vestibule pressurization fans. Measure air quantity delivered by fan and inlet points. Measure airflow rate through relief openings in stairway. Measure pressure differential between floor area, vestibule and stairwell in three locations per stair (2nd floor, mid-height, top floor).

3.8 FIRE AND LIFE SAFETY VENTILATION SYSTEMS PROCEDURE

A. All testing and balancing is required for equipment, systems and terminal devices during normal operation and fire alarm and life safety operation.

B. The life safety and smoke control and ventilation systems shall be performance tested by demonstration of the proper sequences of the fire and life safety ventilation system, automatic damper operation, stair and vestibule door opening and closing forces and other functions involved. Tests shall demonstrate the activation of the smoke detection system and smoke control system, in accordance with the procedures and test criteria established by the local Authorities Having Jurisdiction. The mechanical, fire protection, fire alarm, electrical, and Building Management System Contractor and the General Contractor shall be present and shall participate during the entire testing procedures. The mechanical subcontractor shall furnish the smoke bombs, ladders, tools, etc.

C. The Contractor shall verify and record that the required pressure differences, the required quantity of air specified or indicated on the Drawings is supplied, relieved or exhausted. Tests shall demonstrate the proper sequence of the fire safety ventilation systems, the activation of the smoke detection system, smoke control system, and make-up air systems. The smoke control systems installed in this Project shall be performance tested in accordance with the requirements of the Authorities Having Jurisdiction and the Fire Department. The demonstration tests shall be conducted and repeated until they are accepted and approved by the Authorities Having Jurisdiction. The mechanical subcontractor shall include all costs associated with the required demonstration tests, including smoke bombs, instrumentation, etc. Perform a minimum of one successful test of each sequence witnessed by the Architect prior to any demonstration test for Authorities Having Jurisdiction.

3.9 BALANCING DATA

A. Air Handling Equipment Installation Data:

1. Manufacturer, model and size
2. Arrangement, discharge and class
3. Motor type, horsepower, speed, efficiency, voltage, phase, cycles and full load amperes
4. Location and final identification

B. Air Handling Equipment Design Data:

1. Total airflow rate
2. Static pressure across coil, filter, damper, mixing box sections and total
3. Motor horsepower, speed, efficiency, voltage and amperes
4. Fan speed and brake horsepower
5. Hydronic coil inlet and outlet, dry bulb temperatures
6. Initial filter air pressure drop

C. Air Handling Equipment Recorded Data:

1. Total airflow rate
 2. Static pressure across coil, filter, damper, mixing box sections and total
 3. Fan speed and brake horsepower
 4. Motor operating amperes
 5. Inlet and outlet, dry bulb temperatures
 6. Filter air pressure drop
- D. Duct Air Quantities: Mains, Branches, Outside Air and Exhausts (Maximum and Minimum):
1. Duct sizes
 2. Number of pressure readings
 3. Sum of velocity measurements
 4. Average velocity
 5. Duct recorded airflow rate
 6. Duct design airflow rates
- E. Air Inlets and Outlets:
1. Inlet/outlet identification location and designation
 2. Manufacturer's catalogue identification and type
 3. Application factors
 4. Design and recorded velocities
 5. Design and recorded airflow rates
 6. Deflector vane or diffuser cone settings
- F. Building Pressurization Data:
1. Outside air temperatures and humidities
 2. Outside wind velocity
 3. Building pressures plotted with respect to systems
 4. Supply air, return air and exhaust airflow rates for varying damper positions
 5. Locations of pressure measuring points, inside and outside building
- G. Stair and Stair Vestibule Pressurization Data:
1. Stair Supply airflow rates
 2. Exhaust or relief opening flow rates
 3. Vestibule to floor pressure differential each floor
 4. Stair to vestibule pressure differential each floor
- H. Smoke Exhaust Data: Supply and Exhaust Flow Rate
- I. Air Heating and Cooling Equipment Design Data:
1. Heat transfer rate
 2. Water pressure drop across coil
 3. Air static pressure drop
 4. Entering and leaving water temperatures
 5. Entering and leaving air dry and wet bulb temperatures
- J. Air Heating and Cooling Equipment Recorded Data:
1. Element type and identification
 2. Entering and leaving air dry and wet bulb temperatures

3. Entering and leaving water temperatures
4. Water pressure drop across coil
5. Water pressure drop across bypass valve
6. Air static pressure drop
7. Air and water flow rates
8. Adjusted temperature rise or drop

K. Sound Level Data:

1. Diagram or description of relationship of sound source to measuring instrument
2. Overall decibels (A) level
3. Reading at each octave band frequency from 31.5 Hz to 16 kilohertz
4. Noise criteria (NC) curves plotted and compared to those recommended by ASHRAE or AABC publications.

L. Sound Level Recorded Data:

1. Air Inlets and Outlets
2. VRF Fan Coil Units
3. VRF Condensing Units
4. Packaged Makeup-Air Units
5. VFDs
6. Fans

END OF SECTION 23 05 93

SECTION 23 07 00 – INSULATION FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include, but is not limited to, the following:
 - 1. Duct insulation, jackets
 - 2. Piping insulation, jackets
 - 3. Fire barrier duct wrap

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 21 13 – Hydronic Piping (NOT APPLICABLE)
- C. Section 23 23 00 – Refrigerant Piping and Accessories
- D. Section 23 31 13 – HVAC Ducts and Casings
- E. Section 23 05 13 – Acoustics
- F. Division 7 – Thermal and Moisture Protection – Section(s) re: Applied Fireproofing

1.3 REFERENCE STANDARDS

- A. ASTM – American Society for Testing and Materials
 - 1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 2. ASTM C411 Standard Test Method for Hot-Surface Performance of High- Temperature Thermal Insulation
 - 3. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 4. ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
 - 5. ASTM C534/C534M Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - 6. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation
 - 7. ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - 8. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - 9. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 10. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
 - 11. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C
 - 12. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems
 - 13. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
 - 14. ASTM F1249 Standard Test Method for Water Vapor Transmission Rate
- B. OPL – Omega Point Laboratories, Inc.
 - 1. Duct System – design numbers GD531F, GD532F, etc.
 - 2. Plenum Protection System – design numbers PP100F, PP101F, etc.
 - 3. Through Penetration System – design numbers FS557W, FS558F, FS559W, FS560F, FS561F, FS562W, FS563W, etc.
- C. NFPA – National Fire Protection Association
 - 1. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
 - 2. NFPA 225 Model Manufactured Home Installation Standard
 - 3. NFPA 262 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- D. UL – Underwriters Laboratories Inc.
 - 1. UL 723 Test for Surface Burning Characteristics of Building Materials
 - 2. UL 1978 Grease Ducts (Sections 12 and 13)
- E. International Mechanical Code
- F. Uniform Mechanical Code

- G. International Building Code
- H. California Building Code
- I. California Energy Code

1.4 QUALITY ASSURANCE

- A. All insulation shall be in accordance with Title 24.
- B. Insulation supplier and insulation installer shall have a minimum of 5 years' successful installation experience on projects of similar scope to this project.
- C. Fire-rated duct wrap installer shall have demonstrated experience on projects of similar size and complexity.

1.5 SUBMITTALS

- A. Product Data: Provide product description, current Product Data Sheets, list of materials and thickness for each service or equipment scheduled, locations, and manufacturer's installation instructions.
- B. Submit details of sheet metal boxes for pieces of insulated equipment. Refer to sub-Clause 2.06, A.7.
- C. Samples: Submit selection and verification samples of fire-rated duct wrap.
- D. Quality Assurance / Control Submittals:
 - 1. Test Reports: Upon request, provide fire tests from recognized laboratory.
 - 2. Certificates: Submit manufacturer's certificate that product(s) meet or exceed specified requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions during storage and installation of all products required by manufacturers of adhesives, mastics, and insulation cements.
- B. Protect insulation from contact with water.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass: Johns Manville; Knauf; Owens Corning.
- B. Calcium Silicate: Johns Manville; Extol of Ohio, Inc.
- C. Elastomeric: Armacell; Aeroflex.
- D. Cellular Glass: Pittsburgh Corning.
- E. Mastics, Adhesives and Sealers: Ductmate; Foster; IC; Childers.
 - 1. Vapor Barrier Mastic: Foster 30-65, Childers CP-34, IC – 501. Permeance shall be 0.03 perms or less at 45 mils per ASTM E96. Product must comply with California Dept of Public Health (CDPH) Standard Method Ver. 1.1, 2010 Small Scale Environmental Chamber Test for VOCs. for CA Specification 01350.
 - 2. Weather Barrier Breather Mastic: Foster 46-50, Childers CP-10/11 or approved equal.
 - 3. Lagging Adhesive/coating: Foster 30-36, Childers CP-50AMV1 or approved equal.
 - 4. Reinforcing Mesh: Foster Mast a Fab, Childers Chil Glas #10.
 - 5. Calcium Silicate Insulation Adhesive: Foster 81-27, Childers CP-97, Vimasco 760.
 - 6. Fiberglass Insulation Adhesive: Foster 85-60, Childers CP-127, or approved equal. Comply with ASTM C916, Type II.
 - 7. Metal Jacketing/Flashing Sealant: Foster 95-44, Childers CP-76 or approved equal.
- F. Jackets:
 - 1. Metal: Childers; RPR Products.
 - 2. PVC: Ceel-Co; PIC Plastics.
 - 3. Other: Venture Tape; Polyguard, Foster Vapor Fas 62-05.
- G. Pre-Molded Fittings, Valves, Strainers and Equipment Insulation: Insul-Therm International; Extol of Ohio, Inc.; or approved equal.
- H. Fire Barrier Duct Wrap: 3M Duct Wrap 615+; Unifrax FyreWrap®; or approved equal.

2.2 GENERAL

- A. Conform to application schedule for type and thickness of insulation.
- B. Insulation, jacket, facing and adhesives shall be non-combustible material meeting Code requirements and fire and smoke hazard ratings as tested by procedure ASTM E84, National Fire Protection Association 225, and UL 723, not exceeding Flame Spread 25 and Smoke Developed 50.
- C. Adhesive, mastic or insulating material shall not contain asbestos.
- D. Vapor jacket permeance shall be 0.02 perms or less.
- E. Jacket puncture resistance shall be 50 units (Beach) or greater.
- F. Provide fire-rated duct wrap materials and systems which have been manufactured, fabricated and installed to a 2-hour Fire Resistance Rating (ASTM E119, ASTM E814):
 - 1. Through penetration system's design assembly number(s): FS557W, FS558F, FS559W, FS560F, FS561F, FS562W, FS563W.
 - 2. Duct system's design assembly number(s): GD531F, GD532F.
 - 3. Flame-propagation and smoke-density values (UL 910 / NFPA 262):
 - a. Maximum flame spread (feet): 0.01.
 - b. Maximum smoke (optical density): 0.01.
 - c. Average smoke (optical density): 0.00.
 - 4. Plenum Protection system's design assembly number(s): PP100F, PP101F

2.3 PIPE INSULATION MATERIALS

- A. Glass Fiber: ASTM C547; rigid molded, non-combustible.
 - 1. Installed 'K' Value: 0.23 Btu-in./hr-ft²-°F at 75°F.
 - 2. Maximum Service Temperature: 850 °F.
 - 3. Vapor Retarder Jacket: White kraft paper, vinyl coated, embossed and reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips.
- B. Hydrous Calcium Silicate: ASTM C533; rigid molded pipe.
 - 1. Installed 'K' Value: 0.40 Btu-in./hr-ft²-°F at 300°F.
 - 2. Maximum Service Temperature: 1,200 °F.
 - 3. Tie Wire: 16-gauge stainless steel with twisted ends on maximum 12-inch centers
- C. Elastomeric Foam: ASTM C534/C534M flexible cellular elastomeric, molded or sheet.
 - 1. Installed 'K' Value (1-inch and less): 0.245 Btu-in./hr-ft²-°F at 75°F.
 - 2. Installed 'K' Value (1-1/2 inch and 2 inch): 0.28 Btu-in./hr-ft²-°F at 75°F.
 - 3. ESTM 84 25/50 flame/smoke spread up to 2-inch thickness.
 - 4. Water vapor transmission: 0.03 Perms.
 - 5. Maximum Service Temperature: 220 °F.
- D. Cellular Glass:
 - 1. Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
 - 2. Preformed Pipe Insulation with Jacket: Comply with ASTM C552, Type II, Class 2.
- E. Field-Applied Jackets:
 - 1. PVC Plastic (PVC): One-piece molded type fitting covers and sheet material, gloss white. Connections shall be pressure-sensitive color-matching vinyl tape.
 - 2. Canvas Jacket (CJ): UL Listed fabric, 6 ounce per square yard, plain weave cotton treated with dilute fire-retardant lagging adhesive.
 - 3. Aluminum Jacket (AL): 0.016-inch thick sheet, stippled finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory-attached protective liner.
 - 4. Stainless Steel Jacket (SSJ): Type 304 stainless steel, 0.010 inch, smooth finish.
 - 5. Vapor Barrier Jacket (VBJ): Five ply, non-bituminous, embossed, aluminum foil/polymer laminated film with permeance rating of 0.0 as tested in accordance with ASTM F1249 . Venture Clad Plus (1579CW) by Venture Tape, Polyguard Zero-Perm (indoors only), Foster Vapor Fas 62-05 or approved equal.

2.4 PIPE INSULATION SCHEDULES

A. Insulation Schedules:

Service	Temp. Range (°F)	Material	Insulation Thickness (inches) for Pipe Sizes:				
			< 1	1 to < 1.5	1.5 to 4	4 to <8	8 and up
Refrigerant	Below 40	Elastomeric foam, glass fiber, cellular glass	1.0	1.5	1.5	1.5	1.5
Refrigerant	40 to 60	Elastomeric foam	0.75	0.75	1.0	1.0	1.0
Condensate drains above hung ceilings	All	Elastomeric foam, glass fiber	0.5	0.5	0.5	--	--
Diesel engine exhaust, fire pump exhaust, silencer/muffler/precipitator	All	Calcium silicate	--	--	4.5	4.5	4.5

PIPE INSULATION THICKNESS										
TABLE 120.3 A PIPE INSULATION THICKNESS (2022 BUILDING EFFICIENCY CODE)										
FLUID OPERATING TEMPERATURE RANGE(°F)	INSULATION CONDUCTIVITY			NOMINAL PIPE DIAMETER (IN INCHES)						
	CONDUCTIVITY (IN BTU-IN/H PER FT2 °F)	MEAN RATING TEMPERATTURE (°F)		<1	1 TO <1.5	1.5 TO <4	4 TO <8	8 & LARGER		
				INSULATION THICKNESS REQUIRED (IN INCHES)						
copy			MIN. PIPE INSULATION REQUIRED (THICKNESS. IN INCH or R-value)							
ABOVE 350	0.32-0.34	250	INCHES	4.5	5.0	5.0	5.0	5.0		
			R-VALUE	R37	R41	R37	R27	R23		
251-350	0.29-0.32	200	INCHES	3.0	4.0	4.5	4.5	4.5		
			R-VALUE	R24	R34	R35	R26	R22		
201-250	0.27-0.30	150	INCHES	2.5	2.5	2.5	3.0	3.0		
			R-VALUE	R21	R20	R17.5	R17	R14.50		
141-200	0.25-0.29	125	INCHES	1.5	1.5	2.0	2.0	2.0		
			R-VALUE	R11.5	R11	R14	R11	R10		
105-140	0.22-0.28	100	INCHES	1.0	1.5	1.5	1.5	1.5		
			R-VALUE	R7.7	R12.5	R11	R9	R8		
			NOMINAL PIPE DIAMETER (IN INCHES)							
			<1	1 TO <1.5	1.5 TO <4	4 TO <8	8 & LARGER			
SPACE COOLING SYSTEMS (CHILLED WATER, REFRIGERANT & BRINE)			MINIMUM PIPE INSULATION REQUIRED (THICKNESS IN INCHES OR R-VALUE) ¹							
40-60	0.21-0.27	75	INCHES	NONRES 0.5	RES 0.75	NONRES 0.5	RES 0.75	1.0	1.0	1.0
			R-VALUE	NONRES R3	RES R6	NONRES R3	RES R5	R7	R5	R5
BELOW 40	0.20-0.26	50	INCHES	1.0	1.5	1.5	1.5	1.5	1.5	
			R-VALUE	R8.5	R14	R12	R9	R9		
FOOTNOTE TO TABLE 120.3-A: 1. THESE THICKNESS ARE BASED ON ENERGY EFFICIENCY CONSIDERATIONS ONLY. ISSUES SUCH AS WATER VAPOR PERMEABILITY OR SURFACE CONDENSATION SOMETIMES REQUIRE VAPOR RETARDERS OR ADDITIONAL INSULATION.										

B. Fittings, Valves and Flanges:

1. Use factory pre-molded fittings of the same materials and thickness as the adjacent pipe insulation. Such fittings shall be applied to all 90°s, 45°s, Tee's, flanges, and valves.
2. Where pre-molded insulation fittings are not manufactured, insulate fittings, flanges, strainers and valves with mitered segments of the same density as the adjoining pipe covering. Vaporseal for cold (below dew point) applications using vapor barrier mastic with open weave glass or polyester mesh

lay in while wet. Provide a final coat of vapor barrier mastic. Overlap glass mesh and outer coat adjacent covering by a minimum of 2 inches. Vapor barrier mastic shall be IC 501, Childers CP-34 or Foster 30-65. Permeance of mastic shall be 0.03 perms or less at 45 mils as tested by ASTM E96. Reinforcing mesh shall be Foster Mast a Fab, Childers Chil Glas #10 or approved equal.

3. Provide insulation for the removable covers and flanges of pipe strainers on cold services with built-up sections of glass fiber pipe covering, arranged to facilitate servicing of the strainer. Complete applications with vaporseals as specified above. Vapor barriers shall be sealed and continuous through guides, hangers, walls, sleeves, etc. Adhesives and coatings shall be as noted herein.
 4. Insulate fittings, flanges, valves, etc. for services where calcium silicate insulation is specified with mineral wool cement of equal thickness to the pipe insulation.
Apply evenly and finish with glass cloth.
- C. High-Pressure Steam Valves: Provide removable shop-fabricated fiberglass padding rated for 500°F. Line with thin wire mesh and cover with eighteen-ounce high-temperature woven fiberglass cloth with integral Velcro strap fasteners.
- D. Jacketing Schedule:

Service	Location	Jacket Type
Refrigerant piping	Interior locations	None
	Exterior locations	VBJ or painted finish
Condensate	All locations	ASJ or painted finish
Diesel engine exhaust, silencer/muffler and precipitator	All locations (not part of the prefabricated flue)	AL

2.5 DUCTWORK INSULATION

A. Materials:

1. Flexible Glass Fiber: ASTM C553, formaldehyde-free flexible blanket.
 - a. Installed 'K' Value: 0.27 Btu-in./hr-ft²-°F at 75°F.
 - b. Density: 0.75 pounds per cubic foot.
 - c. Vapor Barrier Jacket: Aluminum foil reinforced with fiberglass yarn and laminated to fire-resistant kraft paper, secured with 2-inch wide UL Listed pressure-sensitive tape and outward clinched expanded staples and vapor barrier mastic as needed. Maximum vapor barrier perm rating shall not exceed 0.02 perms.
2. Rigid Glass Fiber: ASTM C612, rigid board.
 - a. Installed 'K' Value: 0.23 Btu-in./hr-ft²-°F at 75°F.
 - b. Density: 6.0 pounds per cubic foot.
 - c. Vapor Barrier Jacket: Aluminum foil reinforced with fiberglass yarn and laminated to fire-resistant kraft paper, secured with 2-inch wide UL Listed pressure-sensitive tape and outward clinched expanded staples and vapor barrier mastic as needed.
3. Canvas Jacket: UL Listed fabric, 6 ounces per square yard, plain weave cotton treated with dilute fire-retardant lagging adhesive: Foster 30-36; Childers CP-50AMV1 or approved equal.
4. Covering for Outdoor Ducts:
 - a. Aluminum Jacket: 0.016-inch thick sheet, stucco-embossed finish, with longitudinal slip joints and 2-inch laps.
 - b. Ultra-violet light-resistant painted polyvinyl chloride covering with joints secured and sealed with adhesive.
 - c. Vapor Barrier Jacket (VBJ): Five ply, non-bituminous, embossed, aluminum foil/polyester laminated with permeance rating of 0.0 per as tested in accordance with ASTM F1249. Venture Clad Plus (1579CW) by Venture Tape, Foster Vapor Fas 62-05 or approved equal.

B. Schedule:

Service	Material	Thickness (inches)
DUCT INSULATION REQUIREMENTS		
DUCT LOCATION	INSULATION R-VALUE	INSULATION THICKNESS
- OUTDOORS - VENTED ATTIC SPACE - UNCONDITIONED SPACE - SPACE BETWEEN ROOF AND INSULATED CEILING	R-8	2"
- ENCLOSED IN DIRECTLY CONDITIONED SPACE	NONE REQUIRED	N/A
- IN UNVENTED ATTIC	R-6	1.5"
- IN RETURN AIR PLENUM- ALL OTHER SPACES	R-6	1.5"

- C. Wherever external duct insulation is specified, and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specifications for the same location, the external insulation may be omitted.

2.6 EQUIPMENT INSULATION

A. Materials:

- Flexible Fiberglass Blanket: ASTM C553.
 - Installed 'K' Value: 0.24 Btu-in./hr-ft²-°F at 75°F.
 - Maximum Service Temperature: 450°F.
 - Density: 6.0 pounds per cubic foot.
 - Vapor Retarder Jacket: Aluminum foil reinforced with fiberglass yarn and laminated to fire-resistant kraft paper, secured with UL Listed pressure-sensitive tape and outward clinch expanding staples and vapor barrier mastic as needed. Maximum vapor barrier perm rating shall not exceed 0.02 perms.
- Rigid Fiberglass Board: ASTM C612.
 - Installed 'K' Value: 0.23 Btu-in./hr-ft²-°F at 75 °F.
 - Maximum Service Temperature: 450 °F.
 - Density: 6.0 pounds per cubic foot.
 - Vapor Retarder Jacket: Aluminum foil reinforced with fiberglass yarn and laminated to fire-resistant kraft paper, secured with UL Listed pressure-sensitive tape and outward clinch expanding staples and vapor barrier mastic as needed. Maximum vapor barrier perm rating shall not exceed 0.5 perms.
 - Facing: 1-inch galvanized hexagonal wire mesh stitched on one face of insulation.
- Rigid Fiberglass Board: ASTM C612, non-combustible.
 - Installed 'K' Value: 0.23 Btu-in./hr-ft²-°F at 75 °F.
 - Maximum Service Temperature: 850°F.
 - Density: 3.0 pounds per cubic foot.
 - Facing: 1-inch galvanized hexagonal wire mesh stitched on one face of insulation.
- Hydrous Calcium Silicate: ASTM C533, rigid molded block.
 - Installed 'K' Value: 0.40 Btu-in./hr-ft²-°F at 300 °F.
 - Maximum Service Temperature: 1,200°F.
 - Attachment: Insulation shall be securely banded in place, tightly butted, joints staggered and secured with 16-gauge stainless steel wire or ½-inch by 0.015-inch galvanized steel bands on 12-inch maximum centers for large areas.
- Elastomeric Foam: ASTM C534, flexible cellular elastomeric, molded or sheet.
 - Installed 'K' Value (1-inch and less): 0.245 Btu-in./hr-ft²-°F at 75°F.
 - Installed 'K' Value (1-1/2 and 2 inch): 0.28 Btu-in./hr-ft²-°F at 75°F.
 - ESTM 84 25/50 flame/smoke spread up to 2-inch thickness.
 - Water vapor transmission: 0.03 Perms.

- e. Maximum Service Temperature: 220°F.
- 6. Apply the vaporseal board by mechanical fasteners such as Graham pins and speed washers. Seal joints with an adhesive, as approved and reinforced with a glass cloth membrane over vinyl mastic, or self-sealing matching tape. Cover pinheads with adhesive, as specified. If vaporseal board is wired, use sheet metal edges to protect the corners of the board from the wire. Seal edges and joints.
- 7. Enclose removable covers or heads for equipment, (such as coolers, strainers, heat exchangers and pumps) in aluminum sheet metal boxes for easy removal with fiberglass board applied to inside of sheet metal boxes of thickness as described above. Provide lifting handles for removal of boxes.
- 8. Install equipment insulation in accordance with manufacturer's instructions.
- B. Mastics, Adhesives, and Sealants:
 - 1. Apply in accordance with the manufacturers written instructions.

2.7 FIRE-RATED DUCT WRAP

Provide products and materials as follows:

- A. Nominal 1.5-inch thick, 6 pounds per cubic foot density, inorganic, non-asbestos, noncombustible, bio-soluble, high temperature, core insulation blanket.
- B. Flexible, full encapsulation, integral to the duct wrap to provide 2-hour fire resistive enclosure assembly per codes and standards listed in Paragraph 1.02 of this document.
- C. Blanket fiber materials shall be tested per EU regulatory requirements, Directive 97/69/EC for bio-solubility, and verified by an independent laboratory.
- D. Provide rated access doors (for clean-outs as required) to maintain 2-hour rating and required clearance.
- E. Provide firestop sealants, tape, insulation pins, clips, banding and other components as per manufacturers' instructions to ensure installation complies with the complete tested system and corresponding Design Listing(s).
- F. Aluminum foil tape: Acceptable to wrap material manufacturer.
- G. Filament tape: Minimum 3/4-inch wide.
- H. Banding material and banding clips:
 - 1. Material: Carbon steel or stainless steel.
 - 2. Width: Minimum 1/2 inch.
 - 3. Thickness: Minimum 0.015 inch.
- I. Insulation pins:
 - 1. Material: Copper-coated steel.
 - 2. Size: Minimum 12 gauge.
- J. Speed clips:
 - 1. Material: Galvanized steel.
 - 2. Type and size: Minimum 1.5 inches square or 1.5 inches diameter round or
 - 3. equivalent sized insulated cup-head pins.
- K. Access door hardware:
 - 1. Type: Threaded rods with 1/4-inch wing nuts and 1/4-inch washers.
 - 2. Material: Galvanized steel.
 - 3. Diameter: 1/4 inch.
 - 4. Length: 4.5 inches to 5 inches
- L. Access door hardware:
 - 1. Type: Hollow tubing to fit threaded rods.
 - 2. Material: Steel.
 - 3. Length: 4 inches.

PART 3 – EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that ductwork has been tested for leakage in accordance with Section 23 31 00 –HVAC Ducts and

Casings before applying insulation materials.

- B. Verify that all surfaces are clean, dry and free of dirt, duct, debris, moisture or foreign material.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Verify piping has been pressure-tested as specified in Section 23 21 13 – Hydronic Piping before applying insulation materials to pipe joints.
- C. Continue insulation and vapor barrier through penetrations.
- D. Piping, Valve and Accessories Insulation:
 - 1. Locate insulation and cover seams in least visible locations where exposed.
 - 2. Neatly finish insulation at supports, protrusions, and interruptions.
 - 3. Provide insulated pipes, fittings, valves and accessories conveying fluids below ambient temperature with continuous vapor retarder jackets with self-sealing laps. Insulate complete system and provide molded flexible polyvinyl chloride jacket(s) for all fittings and valves. Vaporseal all below ambient jacket seams with vapor barrier mastic as recommended by the insulation manufacturer.
 - 4. For insulated pipes, fittings, valves and accessories conveying fluids above ambient temperature, secure jackets with self-sealing lap. Bevel and seal ends of insulation at equipment, flanges and unions.
 - 5. Protect pipe insulation at hangers, guides, and rollers with 20-gauge galvanized metal shields, one-third the insulation circumference in width and minimum 10 inches in length up to 2½-inch pipe size, 12 inches in length on pipes 3-inch and larger, on the outside of the insulation and vapor barrier or jacket. Center shield on hanger and hold shield in place by straps or by manufactured centering tabs or channels on the shield itself. Do not pierce the insulation with hangers.
 - 6. Provide insert between support shield and piping. Fabricate of calcium silicate, rigid phenolic or other heavy density non-deforming insulating material suitable for temperature. Length of insulation inserts shall match support shield length as specified.
 - 7. For exterior applications or locations where abrasion or damage may occur, provide weather protection jacket. Insulated pipe, fittings, accessories joints, and valves shall be covered with ultra-violet light-resistant painted polyvinyl chloride, Foster Vapor Fas 62-05 flexible jacketing or aluminum jacket. Jacket seams shall be located on bottom side of horizontal piping.
 - 8. Apply prefabricated sectional insulation for straight pipes neatly fitted around the piping, and sealed with adhesive. Apply adhesive to only one side of each joint and not to pipe surface.
 - 9. Seal all joints with Foster 30-65 or Childers CP-34 fire-resistant vapor barrier mastic. Oversized pipe sections or board type insulation may be used to fabricate and install insulation around pipe specialties. All void spaces shall be firmly filled with flexible insulation to support oversized pipe insulation.
 - 10. Secure sectional insulation with 0.02-inch thick by ½-inch wide aluminum bands manufactured by Childers, or RPR Products nylon ties, on 24-inch centers for pipe sizes 2 inches and larger. Install at least two (2) bands per section of insulation.
 - 11. Insulate refrigerant vertical riser support clamps.
 - 12. Insulate and thoroughly vaporseal control valve bodies where the valve actuator penetrates the insulation.
 - 13. Thoroughly vaporseal the ends of all refrigerant pipe, valve and fitting insulation sections to prevent condensation from wicking between sections.
 - 14. Replace any self-sealing insulation or lap that is found to be not sealing properly. Do not use staples to secure the insulation or coverings.
 - 15. Thermal Insulation for Diesel Engine Exhaust Piping:
 - a. Insulate the muffler/silencer and precipitator with three layers of 1.5-inc thick hydrous calcium silicate, installed over spacers to allow a 1-inch air space between pipe and insulation. Include all flexible pipe connections.
 - b. Stagger joints for the first, second and third layers.

- c. Apply aluminum jacket (ASTM B209) over outer layer of insulation as specified.
- d. Wrap or pack all protrusions through the insulation with refractory fiber. Seal all chips, joints and cracks.
- e. Provide expansion joints in the insulation and aluminum jacket as recommended by the manufacturer to allow for movement of the flexible pipe connections, and differential expansion between the diesel engine exhaust pipe, insulation and jacket.
- f. Refer to Section 23 51 00 "Breechings, Chimneys and Stacks" for exhaust from the silencer/muffler or precipitator to outside the building.

M. Fire barrier silicone sealant: Manufacturer designation: 1000 N/S, 1003 S/L, 2000+.

3.3 FIRE BARRIER DUCT WRAP

A. Site Verification of Conditions:

- 1. Verify that site conditions are acceptable for installation of fire barrier wrap
- 2. Do not proceed with installation of fire barrier wrap until unacceptable conditions are corrected.

B. Surface Preparation: Ensure that surfaces of all openings and penetrating items are clean, dry, frost-free and free of dust.

C. Comply with installation requirements of fire-tested assembly design.

D. Fire Barrier Duct Wrap Installation:

- 1. To minimize waste, roll out fire barrier duct wrap material tautly before measuring.
- 2. Wrap fire barrier duct wrap blanket around the perimeter of the duct and cut to a length to overlap itself not less than 3 inches so that the overlap made by adjacent blankets forms a longitudinal overlap.
- 3. Seal all cut edges of the blanket and any tears in the foil scrim with aluminum foil tape.
- 4. Telescoping 3-Inch Overlap Wrap Method: Install each blanket overlapping the adjacent blanket, so that each blanket has one edge exposed and one edge covered by the next blanket and the visible edges of the perimeter overlaps all point in the same direction.
- 5. Checkerboard 3-Inch Overlap Wrap Method: Install blankets with both edges exposed alternating with blankets with covered edges so that the visible edges of the perimeter overlaps alternate their directions and appear on every other blanket.
- 6. Butt Joint with Collar Method: Install adjacent blankets butted tightly together with a 6-inch wide collar of fire barrier duct wrap centered over the joint, overlapping each blanket by 3 inches minimum.
- 7. Banding Only:
 - a. Filament tape may be used to temporarily hold the blanket in place until the banding is applied.
 - b. Apply steel banding around the duct 1.5 inches from each edge of the blanket and maximum 10.5-inch centers.
 - c. Place banding around the material and tighten to sufficiently hold the fire barrier duct wrap in place against the duct, compressing the foil but not cutting the foil.
- 8. Additional Pinning to Prevent Sagging of the Wrap:
 - a. For ducts 24 inches and larger in width, additional pins are required to support the blanket on the bottom horizontal surface and on the outside face of a vertical duct run.
 - b. Space pins a maximum of 10.5 inches apart in the direction of the blanket width and a maximum of 12 inches apart in the direction of the blanket length.
- 9. Mechanical Fastening with Pins Only:
 - a. Weld insulation pins to the duct in the centers of the overlaps a minimum of 1.5 inches from each edge of the blanket and spaced a maximum of 10.5 inches on center along perimeter overlap, and a maximum of 10.5 inches on center along longitudinal overlaps.
 - b. Impale blanket over pins and hold in place by galvanized speed clips.
 - c. Insulation pins that extend beyond the blanket wrap shall be turned down to eliminate sharp

points.

- d. Install insulated cup-head pins at the same spacing requirements of the insulation pins.

10. Access Door Installation:

- a. Weld four (4) galvanized steel threaded rods, 1/4-inch diameter by 4.5 to 5 inches long to the duct at the corners of the door opening.
- b. Place four (4) steel tubes, each 3 inches long, over the rods to act as protection for the fire barrier duct wrap when fastening the door.
- c. Weld four (4) insulation pins to the door panel for installation of the blanket.
- d. Cut one (1) layer of fire barrier duct wrap approximately the same size as the access panel and impale over the insulation pins on the panel, fitting this layer tightly against the wrap surrounding the access door opening with no through openings.
- e. Cut a second layer of fire barrier duct wrap so as to overlap the first layer by a minimum of 1 inch and impale over the pins so that both layers are locked in place with galvanized speed clips.
- f. Turn down pins that extend beyond the outer layer of fire barrier duct wrap to avoid sharp points on the door.
- g. Place insulated door panel over the threaded rods and hold in place with washers and wing nuts.

E. PROTECTION

- 1. Protect installed work from damage due before and after installation.

END OF SECTION 23 07 00

SECTION 23 13 39 – ACOUSTICS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work on this section shall include, but is not limited to the following items:
 - 1. Sound attenuators
 - 2. Sound lining
 - 3. Vane axial fan diffuser/silencer

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 05 48 – Vibration and Seismic Controls for HVAC
- C. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
- D. Section 23 07 00 – HVAC Insulation
- E. Section 23 31 13 – HVAC Ducts and Casings
- F. Section 23 37 00 – Air Outlets and Inlets

1.3 REFERENCE STANDARDS

- 1. AMCA – Air Movement and Control Association Standard 300-08, Reverberant Room Method for Sound Testing of Fans
- 2. ANSI – American National Standards Institute Standard S1.13, American National Standard Methods for the Measurement of Sound Pressure Levels In Air
- 3. AHRI (ARI) – Air Conditioning and Refrigeration Institute Standards:
 - a. Standard 440-98 – Standard for Room Fan Coil and Unit Ventilator
 - b. Standard 575-94 – Method of Measuring Machinery Sound within Equipment Rooms
 - c. Standard 885-98 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
- 4. AHRI(ARI)/ADC 880 – Standard for Air Terminals
- 5. ASTM – American Society for Testing and Materials
 - a. C423-08A – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - b. E84-09A – Standard Test Method for Surface Burning Characteristics of Building Materials
 - c. E90-04 – Standard of Test Method for Laboratory Measurement of Air Borne Sound Transmission Loss of Building Partitions and Elements
 - d. E413-04 – Classification for Rating Sound Insulation
 - e. E477-06A – Standard Test for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers
- 6. ISO – International Standards Organization
 - a. ISO 5135 – Acoustics – Determination of Sound Power Levels of Noise from Air-Terminal Devices, Air-Terminal Units, Dampers and Valves by Measurements in a Reverberation Room
 - b. ISO 3741 – Acoustics – Determination of Sound Power Levels of Noise Sources Using Pressure Methods for Reverberation Rooms
- 7. NLVAP – National Voluntary Laboratory Accreditation Program for Acoustical Testing Services
- 8. UL – Underwriters Laboratories: UL 181, Factory-Made Air Ducts and Connectors.
- 9. Refer to Section 23 37 00: Air Inlets and Outlet for additional reference standards.

1.4 QUALITY ASSURANCE

- A. Acoustical Criteria:
 - 1. Noise levels, generated by equipment and ductwork, shall be attenuated to permit attainment of sound pressure levels in all 8 octave bands in occupied spaces that conform to the following Noise Criteria (NC) curves:

- a. Lobbies, corridors, toilets, spaces within 10 feet of duct penetrations through shaft and equipment room walls and floors of equipment rooms: NC-40.
 - b. Conference Rooms:
 1. Small: NC-35
 2. Large: NC-30
 - c. Parking Garages and Storage Spaces: NC-50
 - d. All other spaces: NC-35
2. In addition to complying with the standard full octave band sound pressure levels based on maximum NC design requirements, acoustical performance of mechanical equipment when operating under design conditions shall not create any objectionable pure tones. A pure tone is defined as a peak sound pressure level which, when measured in 1/3-octave band frequencies, is higher by more than 5 decibels than adjacent 1/3-octave band frequencies.
 3. Comply with specified NC levels for radiated noise from terminal and pressure regulating devices and/or duct breakout noise by having full octave band sound pressure levels of at least two contiguous frequencies tangent to the NC spectrum. A single frequency controlled NC environment is considered obtrusive and unacceptable.
 4. During testing of sound attenuators there shall be air flowing through the tested sound attenuators at velocities specified in Paragraph 2.02, plus or minus 5 percent.
- B. Mechanical Performance:
1. Air distribution system equipment; terminal device noise:
 - a. Maximum permissible sound-power levels in octave bands of airborne
 - b. transmissions through the combination of grilles, registers, diffusers, and terminal units, or related pressure reducing devices, when operated in installed condition with 3-feet of unlined duct shall be as follows:

Octave Band Frequency (Hertz)	Octave Band Number	Maximum PWL in Decibels Referred to 10 ⁻¹² Watts for space being served						
		NC-20	NC-25	NC-30	NC-35	NC-40	NC-45	NC-50
63	1	51	54	57	60	64	67	71
125	2	40	44	48	52	56	60	64
250	3	33	37	41	45	50	54	58
500	4	26	31	35	40	45	49	54
1,000	5	22	27	31	36	41	46	51
2,000	6	19	24	29	34	39	44	49
4,000	7	17	22	28	33	38	43	48
8,000	8	16	21	27	32	37	42	47

2. Pressure-reducing terminal devices above ceiling; radiated noise:
 - a. Maximum permissible radiated sound-power levels in octave bands when operated in installed condition over occupied spaces, is as follows:

Octave Band Frequency (Hertz)	Octave Band Number	Maximum PWL in Decibels Referred to 10 ⁻¹² Watts			
		NC-35	NC-40	NC-45	NC-50
63	1	72	76	79	82
125	2	70	74	77	80
250	3	61	65	68	71
500	4	60	64	68	72
1,000	5	57	62	68	72
2,000	6	56	60	65	70
4,000	7	66	70	75	80
8,000	8	65	70	75	80

3. Provide sound lining in accordance with UL 181.

4. Provide all materials in accordance with NFPA, UL and state and local codes.

1.5 SUMITTALS

A. Shop Drawings:

1. Sound attenuators, vane axial fan diffuser/silencer.
2. Sound lining.
3. Certification that sound lining meets erosion test method described in UL 181, Factory Made Air Ducts and Connectors.
4. Non-hardening caulking.
5. Submit certified test data from approved laboratory for pressure drop and insertion loss ratings. ASTM – American Society for Testing and Materials E477 and C423.
 - a. For square or rectangular attenuators: Test results for a 24-inch by 24-inch cross-section attenuator.
 - b. Certification data for pressure drop and net insertion loss: Based on tests of same attenuator.
 - c. Attenuators and tests: Subject to inspection upon request.
 - d. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of 2,000 fpm face velocity.
 - e. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch water gauge static pressure, whichever is greater.

- ### **B. Noise generated by mechanical equipment shall be a guaranteed maximum when operating at the specified conditions.**

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Sound Attenuators and Vane Axial Fan Diffuser/Silencers: Industrial Acoustics, Koppers, Vibro-Acoustics
- B. Sound Linings: Certainteed ToughGuard, Schuller, Owens-Corning Fiberglas
- C. Circular Duct Lining: Casco Circliner, Schuller Spiracoustic
- D. Factory Pre-Fabricated Double Wall Lined Duct: United McGill, Sheet Metal Products
- E. Fire Retardant Adhesive and Sealer: Foster 85-20 or approved equal.
- F. Non-hardening caulking shall be guaranteed to be permanently elastic. Tremco Polybutene or approved equal.

2.2 MATERIALS

A. Vaneaxial Fan Diffuser/Silencer:

1. Construct diffuser/silencers of inorganic, noncombustible materials meeting Code requirements and flame spread rating of 25 and smoke developed of 50.
2. The diffuser/silencer shall be specifically designed for mounting at the inlet and outlet of manufacturer's vaneaxial fan. Diffuser/silencer performance shall be specifically rated with the fan manufacturer and fan size selected. Provide flow direction indicator labels on the exterior casing.
3. Diffuser/silencers shall include an internal core of consistent diameter along the entire length in direction of airflow. The core diameter shall be selected based on the adjacent hub diameter or, in the case of C-frame mounted motors, the motor frame size for the respective fan system on which the diffuser silencer is installed. The core shall be constructed from lock forming quality type G-90 galvanized perforated steel in the same gauge as the internal diffuser core. The core shall be supported by a minimum of three welded radial attachment brackets installed at a 120 degree angle to each other to provide uniform support.
4. Provide 4-inch long, 12-gauge, sleeved end connections as standard. When noted, rolled angle flanges shall be welded to the sleeve by the manufacturer. For units where the minimum

diffuser core diameter is 36 inches or greater, an additional support rod shall be welded between the radial bracket and the sleeve to prevent a twist from being exerted on the internal core by the airflow of the fan.

5. Diffuser/silencers shall function as pressure regain devices to minimize system pressure losses at the fan. Fan selections are based on the regain performance of the diffuser/silencer configurations specified.
6. The diffuser/silencer shall meet the following requirements for dynamic insertion loss (forward flow):

Diffuser Outlet Diameter (inches)	<u>Dynamic Insertion Loss in Decibels</u> Octave Band Center Frequency in Hertz							
	63	125	250	500	1,000	2,000	4000	8000
30	1	2	12	20	26	22	16	12
40	1	8	16	19	19	14	10	9
46	2	9	16	18	19	14	10	10
52	3	10	16	18	16	13	11	10
60	3	11	18	19	17	13	12	10
68	3	11	17	19	17	12	12	10
74	4	12	18	20	16	12	11	10
82	4	12	18	20	16	12	11	10
90	4	12	18	18	15	10	10	10

B. Duct Lining:

1. Low-pressure fiberglass duct liner downstream of terminal units shall be finished with an acrylic polymer facing stenciled NFPA 90.
2. Medium pressure duct liner shall be finished with perforated 24-gauge galvanized
3. sheet metal, 28 percent minimum open area or foil facing.
Thickness:
 - a. In ductwork: Minimum 1 inch matte faced unless otherwise noted on the Drawings or specification.
 - b. In plenums and in supply, return or exhaust duct downstream of local floor equipment rooms: Minimum 2 inches, 3 pound per cubic foot density, semi-rigid.
 - c. For sound lining where used in lieu of external thermal insulation, minimum thickness shall conform to requirements as specified in Section 23 07 00: Insulation.
 - d. Linear Diffuser Supply Plenums: Minimum 0.5 inch, 1.5 pound per cubic foot density.
4. Minimum density ducts: 1.5 pounds per cubic foot.
5. Minimum density, plenums: 3 pounds per cubic foot.
6. Flame-spread shall be maximum 25; fuel contributed and smoke developed shall be maximum 50.
7. Suitable for duct velocity of 4,000 feet per minute. Meet erosion test method described in UL 181.
8. Dynamic Loss Coefficient: Maximum 1.2.
9. K Factor: Maximum 0.23 BTU per inch-hour – degree Fahrenheit – square foot; R Value Minimum: 4.2 at 1-inch thickness.
10. Minimum sound-absorption coefficients (ASTM C423 Type A Mounting) for sound-absorbing duct lining material when tested while mounted per ASTM E795.

Lining Thickness	Noise Reduction Coefficient (NRC) Minimum
0.5 inch	0.45

1.0 inch	0.70
1.5 inch	0.85
2.0 inch	0.95

11. Where acoustically lined circular or oval duct is required, lining shall be positively retained in place.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. In order to obtain satisfactory acoustical performance of the mechanical systems, complete the following:
 1. Duct connections at inlet to the terminals
 2. Air-balancing
 3. Avoid excessive dampering right at the terminals
- B. Duct and duct supports shall not contact ceiling framing, ceiling supports, piping or pipe supports.
- C. Sound Attenuators:
 1. Install in accordance with manufacturer's recommendations to obtain published and specified performance.
 2. Provide 22-gauge galvanized steel wire mesh screen on all sound-attenuator inlets or outlets not connected to ductwork or fans.
 3. Provide water-tight aluminum jacket on all sound attenuators installed outside the building or exposed to the weather. Installation shall comply with SMACNA standards for outdoor installations.
- D. Sound Linings:
 1. Adhere with 6-inch wide strips of adhesive at 12-inch centers at all joints in lining.
 2. In addition, secure with grip nail, standard stamp-on or weld pins, and 2-inch diameter integral or press-on head washers on maximum 16-inch centers and in compliance with SMACNA standards.
 3. Coat all edges with sealer.
 4. Provide continuous sheet metal edge protection nosings at entering and leaving edges of lined duct sections and all joints.
 5. Dimensions of lined ductwork are clear inside dimensions after lining has been installed.
 6. Extent of ductwork sound linings.
 - a. Heating, Ventilating and Air-Conditioning Systems:
 1. Supply: Ductwork within mechanical equipment rooms and not less than 25 feet downstream of mechanical equipment room walls and floor slabs.
 2. Exhaust, Relief and Return: Ductwork in mechanical equipment rooms but not less than 25 feet from fan or 15 feet from room walls, floors or ceiling/slabs.
 - b. Outside air supply systems a minimum distance of 25 feet downstream of fan. Stop lining 10 feet from outside air intake.
 - c. Ductwork installed outside building: All exposed ductwork a minimum of 10 feet downstream of wall, roof or floor penetrations.
 - d. Ventilation systems: As indicated on the Drawings.
 - e. Exhaust systems: As indicated on the Drawings.
 - f. Ductwork downstream of fan coil units, heat pumps, AC units or terminal units: Minimum 10 feet. Branch take-offs to diffusers are not allowed in this 10-foot lined section.
 - g. Ductwork upstream of ducted fan coils, heat pumps, AC units: 4 feet minimum.
 - h. Minimum lengths specified or shown. Provide additional acoustical treatment as required to meet maximum permissible sound-power levels scheduled for equipment.
 7. Sound-lined plenums: As specified and indicated on the Drawings.
 8. All transfer and jumper ducts.

9. All linear diffuser supply plenums.
- E. Soundproofing of Construction:
 1. Required for packing between ductwork and the following construction:
 - a. Fan room and mechanical equipment room walls.
 - b. Floors, except in shafts.
 - c. Sound barrier ceilings.
 - d. Sound-rated walls: Any interior wall or partition with internal insulation.
 - e. Refer to Architectural drawings.
 2. Soundproofing:
 - a. Fill openings with fiberglass blanket or board for full depth of penetration.
 - b. Caulk each side of opening with non-hardening, non-aging caulking compound. Schuller "Duxseal" or approved equal.
 3. Soundproofing may be deleted when firestopping material is provided.
- F. Ductwall External Soundproofing:
 1. Extent:
 - a. Vane axial fans including their inlet and discharge transitions and sound attenuators.
 - b. Where indicated on the Drawings.
 2. Soundproofing Material:
 - a. Fiberglass Board:
 1. Density: 6 pounds per cubic foot.
 2. Thickness: ½ inch greater than height of ductwork angles, but 2 inches minimum.
 - b. External Jacket:
 1. Lead sheet overlapped 2 inches and secured with tape.
 2. Weight: 1 pound per square foot.
 3. Thickness: 1/64 inch.
- G. Sound Attenuators Tests:
 1. After installation, measure total system pressure before and after attenuators.
 2. If pressure loss exceeds maximum static pressure scheduled on the Drawings, replace attenuators and/or modify entrance and/or discharge aerodynamic flow to obtain specified performance.
- H. Do not install flexible duct through walls or ceilings.
- I. Acoustical Testing: The contractor shall cooperate with the test and balance contractor to allow acoustical testing to be executed during the testing and balancing.

END OF SECTION 23 13 39

SECTION 23 31 13 – HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work on this section shall include, but is not limited to the following items:
 - 1. Ductwork
 - 2. Plenums
 - 3. Fasteners and Sealants
 - 4. Duct Cleaning
 - 5. Access Doors
 - 6. Duct Testing
 - 7. Installation of Equipment and Materials Furnished Under Other Sections
 - 8. Duct Drain Piping
 - 9. Installation of Duct Smoke Detectors

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 05 29 – Hangers and Supports for HVAC
- C. Section 23 05 48 – Vibration and Seismic Controls for HVAC
- D. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
- E. Section 23 07 00 – HVAC Insulation
- F. Section 23 33 13 – Dampers
- G. Section 23 33 19 – Acoustics
- H. Section 23 37 00 – Air Outlets and Inlets
- I. Section 23 38 00 – Kitchen Exhaust Filtration and Fan System
- J. Section 23 40 00 – HVAC Air Cleaning Devices
- K. Section 23 82 16 – Air Coils
- L. Section 23 82 17 – Electric Heating Coils
- M. Section 23 84 13 – Humidifiers

1.3 REFERENCE STANDARDS

- 1. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers Handbooks (Latest Editions)
- 2. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc.:
 - a. HVAC Duct Construction Standards, Metal and Flexible
 - b. Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
 - c. HVAC Systems Testing Adjusting and Balancing
 - d. Seismic Restraint Manual, Guidelines for Mechanical Systems
 - e. HVAC Air Duct Leakage Test Manual
- 3. IMC – International Mechanical Code
- 4. UMC – Uniform Mechanical Code, Standard 6-2: Standard for Metal Ducts, Latest Edition
- 5. AABC – Associated Air Balance Council Manual: National Standards for Total System Balance
- 6. ANSI – American National Standard Institute
- 7. NFPA – National Fire Protection Association Standards:
 - a. NFPA 90A, Installation of Air Conditioning and Ventilating Systems
 - b. NFPA 90B, Warm Air Heating and Air Conditioning Systems
 - c. NFPA 96, Exhaust Systems
 - d. NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials – Current Edition.
- 8. ASTM – American Society for Testing and Materials:
 - a. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

- b. ASTM B209-07, Standard Specification for Aluminum Aluminum-Alloy Sheet and Plate
 - c. ASTM A653/A653M – 08, Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process – Current Edition.
- 9. UL – Underwriter’s Laboratories, Standards for Safety:
 - a. UL 181 – Standard Factory-made Air Ducts and Air Connectors
 - b. UL 181A – Standard for Closure Systems for Use With Rigid Air Ducts
 - c. UL 181B – Standard for Closure Systems for Use With Flexible Air Ducts and Air Connectors
 - d. UL 555 – Standard for Fire Dampers
 - e. UL 555C – Standard for Ceiling Dampers
 - f. UL 555S – Standard for Smoke Dampers
 - g. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials
- 10. ACGIH – American Conference of Governmental Industrial Hygienists: Industrial Ventilation – A Manual of Recommended Practice
- 11. The State of California Codes
- 12. Local Codes
- B. Above-referenced standards may be superseded by notes and details on the Drawings and in any specification.
- C. Where two or more references conflict, the most stringent, as determined by Architect, shall take precedence.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A – ‘Installation of Air Conditioning and Ventilation Systems’ unless otherwise specified or referenced.

1.5 PERFORMANCE REQUIREMENTS

- A. Sheetmetal, ductwork, plenums and accessories shall meet or exceed the performance requirements specified in this specification section.

1.6 SUBMITTALS

- A. Submit the following for review:
 - 1. Submit ductwork shop fabrication and shop construction standards prior to submittal of ductwork shop drawings.
 - 2. Ductwork shop fabrication and shop construction standards shall include all applicable shop details and product data. Include the following:
 - a. Duct reinforcement tables for all pressure classes, duct materials galvanized steel and ductwork shapes (rectangular, round, and spiral oval) to be used on this project
 - b. Duct reinforcement tables shall include material gauges, transverse joint reinforcement type and standard shop joint spacing
 - c. Transfer duct construction detail
 - d. Acoustical lining, perforated metal liner, adhesive, nosing and fastening cuts and details
 - e. Installation details for:
 - 1. Volume dampers (single blade and multi-blade type)
 - 2. Remote- and cord-operated remote volume dampers
 - 3. Control dampers
 - 4. Fire dampers
 - 5. Smoke dampers
 - 6. Combination fire/smoke dampers
 - 7. Backdraft dampers
 - f. Duct access doors
 - g. Duct fitting construction details such as rectangular and radius elbows, turning vanes, offsets, branch connections, etc.
 - h. Duct support and attachment details
 - i. Flanged duct connection details for all systems and each manufacturer used on project.

Minimum duct construction gauges shall be as per SMACNA duct reinforcement tables. Duct gauges may not be reduced based on alternative jointing manufacturer's recommendations

- j. Ductwork sealant
 - k. Diffuser ductwork connection details
 - l. Duct penetrating full height partition details
 - m. Flexible connection details
 - n. Duct and plenum construction details
 - o. Submit data on all adhesives, coatings, mastics and duct sealants or caulking to ensure that the LEED requirement is achieved if required.
3. Product Data including manufacturer's installation instructions, application, materials of construction, gauges, descriptive literature, and maintenance data for:
- a. Ductwork and fittings
 - b. Plenums
 - c. Fasteners and sealants
 - d. Access doors
 - e. Chemical resistance of interior duct coatings
4. Shop Drawings:
- a. Fully coordinated 1/4-inch scale dimensioned duct layout drawings of all mechanical rooms, riser elevations, and floor plans, giving complete dimensions for location, elevation, and clearance, showing work of all other Sections and Divisions. Layout drawing shall be prepared with architectural floor plan and ceiling grid background indicating room numbers, ceiling heights, location and elevations of structural components, light fixtures, all piping and other equipment
 - b. 1/4-inch scale dimensioned duct layout drawings of all mechanical rooms, riser elevations, and floor plans, giving complete dimensions for location, elevation, and clearance, showing work of other Sections and Divisions wherever necessary to show coordination
 - c. Access door details
 - d. Flexible connection details
 - e. Duct and plenum construction details
 - f. Provide a separate set of dimensioned drawings or a partial set at enlarged scale showing all penetrations required for ductwork through structural members, floor and roof slabs, concrete walls and precast walls
 - g. Duct materials, reinforcement and construction schedules
 - h. Duct support and attachment details
5. All sheet metal shop drawings shall be drawn in double line indicating actual dimensions of ductwork, fittings and equipment. Shop drawings submitted with ductwork drawn in single line shall be returned without review.
6. Sheet metal shop drawing shall indicate, as a minimum, the following data:
- a. Ductwork sizes and section breaks
 - b. Location of acoustical lining
 - c. Bottom of duct elevations for all ducts or other services in conflict with ductwork
 - d. Diffuser face size, neck size and air quantity
 - e. All volume dampers
 - f. All air conditioning units
 - g. All terminal units
 - h. Dimensioned drawings showing penetrations required for ductwork through structural members, floor and roof slabs, concrete walls and precast walls
 - i. Duct support and attachment details
7. HVAC design drawings shall not be submitted as sheet metal shop drawings.
8. Prior to mounting or hanging of mechanical equipment or ductwork, obtain approval from Architect for proposed method of mounting particularly in existing buildings. Submit weights and location of all mechanical equipment and ductwork to the Architect for approval well in advance of general construction work to allow sufficient time for any structural evaluation,

critique and necessary redesign to accommodate the installation.

1.7 DUCT CLASSIFICATION

- A. Duct classification is based on pressure classification as scheduled in Table 1-1 and as described in SMACNA HVAC Duct Construction Standards, Metal and Flexible. Comply with NFPA 90A when ducts traverse through smoke zones. Comply with UBC/UMC when more stringent than NFPA 90A or SMACNA standards.
- B. Longitudinal Seams: Pittsburgh lock shall be used on all longitudinal seams; snap-lock or button punch seams are not acceptable. If SMACNA seal class A or B is specified, the longitudinal seam shall be sealed from the inside.
- C. Minimum pressure classification for each duct system and appropriate SMACNA table references are as follows:

Duct System	SMACNA Table No.	SMACNA Pressure Classification (inches water gauge)	SMACNA Seal Classification
All rectangular supply ducts on systems with variable or constant volume terminal units from fan discharge to terminal unit	1-6	±3	A
All rectangular supply ducts on systems without terminal units from fan discharge to air outlet	1-5	±2	B
All rectangular ductwork downstream of terminal units. All rectangular return ducts and exhaust ducts, where not used for smoke exhaust	1-4	±1	B
All rectangular return ducts and exhaust ducts where used for smoke exhaust	1-6	±3	A
All round supply ducts on systems with terminal units from fan discharge to terminal unit; and parts of smoke exhaust systems under positive pressure	3-2A	+4	A
All round supply ducts on systems without terminal units from fan discharge to air outlet, and all ductwork downstream of terminal units; and parts of return or exhaust ducts under positive pressure	3-2A	+2	B
All round return ducts and exhaust ducts, where not used for smoke exhaust; and parts of supply system under negative pressure	3-2B	-2	B
All round return ducts and exhaust ducts where used for smoke exhaust and parts of a supply system under negative pressure	3-2B	-4	A

- D. Duct classification is applicable to all ductwork and associated sheet metal work except for the following:
1. Grease, fume and vapor exhaust systems
 2. Field-constructed or factory-fabricated plenum partitions

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Spiral Oval and Round Ducts: United McGill “Uni-form”, Semco, Metco, Ductmate Industries “Spiralmate” and “Ovalmate”
- B. Duct Connection Systems: Ductmate Industries “Ductmate 35” and “Ductmate 45”, Nexus, Ward
- C. Flexible Connections: Ventfabrics “Ventglas” and “Ventlon”, Duro Dyne “Insulfab”, Advance Elastomeric Systems, Ductmate Industries “PROflex”
- D. Flexible Ducts: Automatic Industries “Thermafex M-KE”, United McGill, Genflex “IL”
- E. Fiberglass Ducts and Hardware: Owens-Corning Fiberglass, Certain-Teed, Manville, Duro Dyne “Glasline”
- F. Spring Fasteners: Dzus, Simmons “Quick-Lock”
- G. Duct Protective Coatings: Wisconsin Protective Coating, Varni-lite of America
- H. Duct Sealants: Foster, Childers, Miracle Adhesive, United McGill, Hardcast, Ductmate Industries “PROSeal”.
- I. Spin-in Fittings: Young Regulator, Modular Metals
- J. Flexible Duct Clamps: Aeroquip Ideal, Tridon, Young Regulator
- K. Acoustical Panel Plenums: IAC, Rink, Vibro-Acoustics, United McGill
- L. Access Doors, Ducts: Ventfabrics, Duro Dyne, Ruskin. Use “Ventlok” No. 140 latches, Ductmate Industries.
- M. Access Doors, Plenums: Ventfabrics, Duro Dyne, Elgen
- N. Double Wall Duct: United McGill “Acousti-K27”
- O. Plastic Coated Duct: United McGill “Uni-Coat”
- P. Pressure Relief Panels: Ruskin PRD18, United McGill ARR or ASR

2.2 MATERIALS

- A. Sheet Metal:
 1. Steel Sheets:
 - a. Cold rolled steel sheets, lock forming quality meeting ASTM A653/A653M-08
 - b. Black or galvanized as specified
 - c. Galvanizing: 0.9 ounces per square foot both sides
 2. Stainless Steel Sheets: ANSI Type 316 as specified, with Finish No. 2B or No. 3
 3. Lead Sheets: Federal Specification QQ-L-301a, Grade C., 6 millimeters thick
 4. Aluminum sheets: ASTM B209-07, maximum 0.4 percent copper. Provide mill-finish commercial sheets; 16,000 pounds per square inch minimum strength.
- B. Miscellaneous Products:
 1. Screws and Rivets:
 - a. Same material as sheet, except as noted
 - b. Zinc- or cadmium-plated with neoprene grommets, permitted on galvanized sheets
 - c. Minimum screw size: No. 10
 - d. Minimum rivet size: 4 pound
 2. Duct Sealants:
 - a. Sealing compound shall be flexible, non fibrated, water-based adhesive sealant designed for use in all pressure classes. Sealant shall be UV-resistant, conform to ASTM E84, be UL 723 Listed and meet NFPA requirements for Class 1 ductwork.
 - b. Flange Gasket: Provide a continuous butyl rubber gasket which complies with UL 181 and 723 testing and meets MIL-C 18969B and TTS-S-001657. This material shall not contain vegetable oils, fish oils, or any other type of materials that will support fungal or bacterial

- growth. Gasket width shall match duct flange or angle connection with a minimum thickness of 1/8 inch. Ductmate Industries Model 440 gasket tape or approved equal.
- c. Liner Adhesive used to adhere insulation to metal duct shall comply with NFPA 90A, ASTM C916, Type II and UL 723 specifications. Foster 85-60, Ductmate Industries PROtack Liner Adhesive or approved equal. Adhesive shall meet California Dept of Public Health (CDPH) Standard Method Ver. 1.1, 2010 Small Scale Environmental Chamber Test for VOCs. for CA Specification 01350
 - d. Lagging Adhesive shall be applied to insulated ductwork where the insulated edge of the duct would otherwise be exposed to the airflow. Materials shall comply with ASTM E 84, NFPA 255 or UL 723 testing. Foster 30-36, Childers CP-50AMV1, Ductmate Industries Lag-It or approved equal.
3. Hard-setting joint tape shall be a UL Listed two-part tape consisting of woven fiber tape impregnated with activator/adhesive of polyvinyl acetate type.
 - a. Flame spread: 10 maximum
 - b. Smoke developed: 5 maximum
 4. Spring Fasteners: Self-ejecting oval head stud and receptacle with screwdriver slot.
 5. Provide angles, tie rods and structural steel shapes for reinforcing ducts in accordance with SMACNA HVAC Duct Construction Standards, except as noted.
 6. Slide-on Transverse Joint Connectors:
 - a. Prefabricated slide-on transverse duct connectors and components shall be accepted. Ducts constructed using pre-fabricated systems shall refer to the manufacturer guidelines for sheet gauge, intermediate reinforcement size and spacing, and proper joint reinforcement. Ductmate Industries, Ward, Nexus, or approved equal.
 - b. Formed-on flanges shall be constructed as T-25 A/B flanges, of which the construction guidelines are given in Figure 1-4 of the SMACNA HVAC Duct Construction Standards, Metal and Flexible. No other construction standards pertaining to formed-on flanges shall be accepted.
 - c. Formed-on flanges shall include the use of corner bolts, cleats and gaskets.
 - d. All components shall be metal unless other materials are required by code, or specified.
- C. Flexible Connections shall be used where ductwork connects to rotating, vibrating or noise producing machinery. Connectors shall be attached in such a manner to provide an airtight and waterproof seal.
1. Conform to NFPA 90A and SMACNA HVAC Duct Construction Standards, except as noted.
 2. Provide roll formed 1.5-inch long minimum collar, or match length and width of fan, plenum or machinery connection companion flange:
 - a. Aluminum, 1 gauge heavier than ductwork, plenum, fan or machinery connected.
 - b. Galvanized steel, 26 gauge minimum or matching gauge of ductwork, fan, plenum or machinery connected.
 - c. Other materials same as gauge and material as ductwork, plenum, fan or machinery connected.
 3. Provide 2-inch slack in fabric and install to allow minimum movement of 1 inch.
 4. Length of fabric connections: 4 inches minimum; 10 inches maximum.
 5. Materials:
 - a. Indoor installations shall be a UL Listed, fire-retardant neoprene- or vinylcoated woven fiberglass fabric. Minimum density 30 ounces per square yard and rated to 200 degrees F.
 - b. Outdoor installations shall be a UL Listed ultraviolet light resistant Hypalon-coated woven fiberglass fabric. Minimum density 24 ounces per square yard and rated to 250 degrees F.
 - c. Flame spread rating: 25 maximum, smoke developed rating: 50 maximum
 - d. Insulated connections:
 1. Two layers of fabric with 1-inch thick fiberglass, 1.5 pound density.
 2. Performance as previously specified in 2.02-C-5-b.
 - e. Provide wire-embedded uncoated glass fabric with sewn seams for air temperature over 150 degrees F.
- D. Turning Vanes:
1. Galvanized steel ductwork: Galvanized steel or painted black steel, except as noted.

2. Other ductwork: Same material as ductwork.
3. Construction shall meet or exceed SMACNA "HVAC Duct Construction Standards".
 - a. Use of single wall vanes with 3/4-inch trailing edge shall be limited to maximum air velocity of 2,000 feet per minute and a maximum duct dimension of 18 inches.
 - b. Double wall vanes shall be used in ducts where air velocity exceeds 2,000 feet per minute, or any duct with a dimension over 18 inches.
 - c. Vane length: Provide separate equal-size sections for vane length greater than those previously indicated in Paragraph 1.03: Referenced Standards.
 - d. Vane runners: SMACNA Type 1 or 2 acceptable.
 - e. Tab spacing shall be as specified in Figure 4-3 of the SMACNA Manual, HVAC Duct Construction Standards, Metal and Flexible. Rail systems with non-standard tab spacing shall not be accepted.
- E. Rectangular main duct to round duct take-off fittings shall be factory-fabricated spin-in fittings.
 1. Die-formed, same material as ductwork.
 2. Pressure ratings shall be equal to the duct pressure rating in which they are installed.
 3. Provide balancing damper with locking regulator.

2.3 ROUND AND OVAL DUCTWORK

A. GENERAL:

1. Provide factory-fabricated spiral lock-seam duct, except as otherwise indicated.
2. Factory-fabricated longitudinal seams are acceptable for ducts larger than standard factory sizes and are required where branch sizes, fitting sizes, air inlet or outlet sizes exceed the seam-to-seam dimension.
3. Round and oval ducts joints shall be constructed as follows:
 - a. Up to 20-inch equivalent diameter: Interior slip coupling beaded at center and fastened to the duct with screws. Seal joint with approved sealant continuously applied around joint prior to assembly and after fastening. Make certain that majority of sealant is on the interior of the joint.
 - b. From 21-inch to 72-inch equivalent diameter: Use joining system as described in Item 3.a. above or join using a three-piece gasketed flanged joint consisting of two internal flanges, with integral mastic sealant and one external closure band which compresses the gasket between the internal flanges similar to Ductmate Industries "Spiralmate" or "Ovalmate" or approved equals.
 - c. Greater than 72-inch equivalent diameter: Join using companion angle flanged joints as defined in Figure 3-1 of the SMACNA Manual "HVAC Duct Construction Standards, Metal and Flexible". Duct wall shall be a continuously welded longitudinal seam.
4. Factory-fabricated fittings shall be same manufacturer as duct and the same material and construction as duct in which installed.
 - a. Tees: 45-degree conical tap with center-line take-off, unless otherwise indicated. Provide continuously welded seams.
 - b. Elbows:
 1. Segmented seams or standing segmented seams.
 2. Continuously welded for positive or negative 2-inch water gauge and greater:
 - a. 2 gores – less than 35 degrees
 - b. 3 gores – 36 degrees through 71 degrees
 - c. 5 gores – over 71 degrees to 90 degrees maximum
 - c. For ducts listed below, the following are acceptable:
 1. Die-stamped radius elbows for ducts 8 inches or smaller.
 2. (2) Segmented elbows as specified above for ducts larger than 8 inches.
 3. Use on these duct systems:
 - a. Supply and return ductwork within the residential units
 - b. Exhaust ductwork within the residential units.
 4. Not acceptable:
 - a. Corrugated or flexible metal duct

- b. Pleated elbows
 - 5. Adjustable elbows are acceptable only for:
 - a. Downstream of VAV terminals, heat pumps, fan coil units and packaged air conditioning units
 - b. Portions of exhaust systems and return systems under negative pressure not to exceed 1-inch water gauge
- B. Single-Wall Ducts:
 - 1. Materials of construction:
 - a. Galvanized steel: Supply and return, general and toilet exhaust ducts.
 - b. Type 316 stainless steel: Vapor hoods, shower, dishwasher, laboratory and fume exhaust ducts.
 - c. Aluminum: Vapor hoods, shower, and dishwasher exhaust ducts.
 - d. Black steel with plastic coating. Prime paint outer surfaces: Laboratory and fume exhaust ducts.
- C. Factory-Fabricated Accessories:
 - 1. Couplings
 - 2. Volume dampers
 - 3. Bellmouth fittings
 - 4. End caps
 - 5. Angle rings
 - 6. Insulation ends: Connections of double- to single-wall ducts
 - 7. Access doors: Hinged, framed or pressure relief per SMACNA "HVAC Duct Construction Standards" Figure 2-10

2.4 FLEXIBLE DUCTS

- A. General:
 - 1. Provide UL 181 and UL 181B, Class I air duct with polymeric liner, labeled for compliance with UMC. Use only where indicated.
 - 2. Flexible ducts shall meet criteria as defined in Section 3 of the SMACNA Manual, HVAC Duct construction Standards, Metal and Flexible.
- B. Static Pressure Class up to 1-Inch Water Gauge.
 - 1. Insulated Flexible Duct:
 - a. Maximum working pressure 1-inch water gauge
 - b. Nominal 1-inch insulation with vapor barrier
 - c. Maximum thermal conductivity 0.27 BTUH per square foot per degree F per inch at 75 degrees F
 - 2. Similar to Thermaflex M-KE
 - 3. Use at air inlets and air outlets
- C. Static Pressure Class Over 1-inch up to 10 inches Water Gauge:
 - 1. Insulated Flexible Duct:
 - a. Maximum working pressure 10 inches water gauge
 - b. Nominal 1.5-inch resilient glass fiber insulation with flexible vapor barrier jacket and wire reinforced inner core
 - c. Maximum thermal conductivity of 0.27 BTUH per square foot per degree F per inch at 75 degrees F.
 - d. Maximum length: 12 inches
 - e. Maximum offset: 2 inches
 - 2. Use at inlet connections to variable or constant volume terminal units, sized to match terminal unit.
 - 3. Similar to Thermaflex M-KE
- D. Provide factory-fabricated collar.
- E. Flexible ductwork clamps shall be adjustable screw type stainless steel straps approved for use with flexible ductwork.
- F. Regenerative noise due to air turbulence with the flexible duct shall not exceed the following sound

power levels for a 12-inch diameter duct with an air speed of 1,000 feet per minute:

	Sound Power Levels, dB re: 10-12 Watts, at Octave Band Center Frequency, Hz				
Maximum	125	250	500	1,000	2,000
Regenerative Noise	30	31	30	22	20

2.5 ACCESS DOORS

- A. Access doors shall comply with the SMACNA – Duct Construction Standards, Metal and Flexible, except as noted.
- B. Duct access doors shall be insulated or uninsulated, same as duct. Make completely accessible.
 - 1. Minimum Size:
 - a. 20 inches by 14 inches, 18 inches by 16 inches or larger.
 - b. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inches less than duct width or height.
 - c. Larger sizes where required for access.
 - 2. Systems designed for 2-inch water gauge and less (SMACNA Seal Class B or C) shall utilize a hinged and cam, square framed access door.
 - 3. All other systems shall utilize a hinged access door. Construct door in accord with Figure 2-10 of the SMACNA Manual “HVAC Duct Construction Standards, Metal and Flexible”.
 - 4. Provide in following locations:
 - a. Coils in ducts: entering and leaving side
 - b. Automatic dampers: linkage side
 - c. Balancing dampers and backdraft dampers
 - d. Fire dampers, smoke dampers and combination fire/smoke dampers
 - e. Duct-mounted smoke detectors, sprinkler heads, heat detectors
 - f. Filter banks in ducts
 - g. Fan bearings enclosed in ducts
 - h. Inlet side of each single width centrifugal fan
 - i. Inlet and outlet sides of each in-line centrifugal and axial fan or sound attenuator
 - j. All controls, sensing, processing, transmitting and actuating devices
 - 5. Provide permanent label on all access doors identifying the concealed components as specified above.
- C. Casing and Plenum access doors shall be uninsulated or insulated, same as casings and plenums.
 - 1. Latches similar to Ventlok No. 202
 - 2. Minimum size: 24-inch by 60-inch
 - 3. Provide larger size where required for equipment access, service, maintenance, removal and replacement.
 - 4. Provide in following locations:
 - a. Fan or equipment enclosures
 - b. Coil and filter banks
 - c. Fire alarm devices, sprinkler heads
 - d. Dampers
 - e. All VFDs, controls, sensing, processing, transmitting and actuating devices
 - 5. Doors shall open against pressure.

PART 3 – EXECUTION

3.1 DUCTWORK INSTALLATION

- A. General:
 - 1. Construct with gauges, joints, bracing, reinforcing, and other details per latest UMC, SMACNA, or NFPA unless specified otherwise. Comply with most stringent.

2. Ductwork shall not exceed the deflection limits established in UMC 6-2- Standard for Metal Ducts. Maximum allowable deflection for transverse joints and intermediate reinforcements shall not exceed 0.25-inch for duct widths up to 100 inches and shall not exceed 0.3 percent of the span for duct widths greater than 100 inches.
3. Construct ducts with NFPA 90A gauges when traversing smoke zones.
4. Construct of galvanized sheet metal, except where otherwise indicated or specified.
5. Duct dimensions indicated are net, inside, clear, dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.
6. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.
7. Provide minimum 26-gauge sheet metal construction for ducts crossing fire-rated corridors. Refer to Architectural drawings for wall types and ratings.
8. Install exposed ducts as high as possible but within 48 inches of ceiling. Coordinate with other trades to maintain not less than 90 inches clearance above finished floor, unless indicated otherwise.
9. Transitions: Pitch sides of duct in “diverging” or “converging” airflow.
 - a. Maximum of 15-degree included angle.
 - b. Exception: Provide 7.5-degree concentric diverging velocity cones at the discharge of vane axial fans.
10. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing etc. Insert through air-tight rubber grommets.
 - a. Provide pitot tube openings where required for testing of systems:
 1. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage.
 2. For Pitot tube tests install Ventlok No. 699 and 699-2 instrument test holes.
 3. Coordinate locations of openings with balancing contractor.
 - b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material metal sleeve, flanged on one end for use as plug. Reseal vapor barrier.
11. Duct lining: Install lining in ducts and plenums as specified in Section 23 33 19 Acoustics.
12. Flexible Duct Connections.
 - a. Install:
 1. At connections to fans, sound attenuators, generator fan discharge, fan coils, heat pumps, air conditioning units and all air handling equipment.
 2. As indicated on the Drawings or specified in other sections.
 - b. Install at building seismic joints and building expansion joints.
 - c. Use sacrificial breakaway ductwork sections on both sides of seismic or building expansion joint.
13. Refer to SMACNA duct construction standards for outdoor flexible connection details.
14. Volume dampers:
 - a. Install damper as specified in Section 23 05 00 – Dampers and Section 23 37 00 – Air Outlets and Inlets.
 - b. Install damper in branch duct for all air inlets and outlets at accessible location most remote from air inlet or outlet.

B. Elbows:

1. Use radius elbows in rectangular ducts unless otherwise indicated. Centerline radius shall be a minimum of 150% of duct width.
2. Where space does not permit duct radius specified above, install short radius or square elbow with vanes per SMACNA duct construction standards.
3. Do not use turning vanes in the following applications:
 - a. Grease and vapor exhausts
 - b. Fume hood exhaust
 - c. Breeching
 - d. Toilet exhaust ducts

- e. Any gravity ductwork
 - f. Clothes dryer exhaust
 - g. Hoistway vent
 - 4. For 2-inch water gauge or above pressure class ductwork, spot weld turning vanes to duct.
 - 5. For all 2-way splits in supply, return and exhaust systems, provide 2 elbows, proportionally sized per SMACNA Duct Standards, either radius or square. A single fitting is acceptable with turning vanes and duct openings sized as specified.
- C. Rectangular Duct Joints and Seams:
- 1. Provide standing, longitudinal seams, except where flush drive slip seam is specified.
 - 2. Use grooved seam for exposed ducts except in garages, electrical or mechanical rooms, and where required for clearance.
 - 3. "Duct Connection System" joints, may be used in lieu of standing seams. Plastic clips are only allowed for breakaway connections.
 - 4. Fabricate ductwork and coordinate installation such that seams or joints shall not be cut or interrupted for the installation of branches, fittings, dampers, access doors, air inlets or air outlets.
- D. Joint Sealing:
- 1. Seal to SMACNA Seal Classifications previously specified by one of the following methods:
 - a. 6-ounce canvas strip, 6 inches wide adhered with lagging adhesive.
 - b. Hardcast Two Part II Duct Sealing System: DT-5400 tape with RTA-50 sealant.
 - c. Applications as recommended by manufacturer.
 - 2. Seal punched holes and corner cracks (Duct Tape Not Allowed).
 - 3. After installation and testing, reseal joints found to be leaking.
- E. Ducts Out-of-Doors:
- 1. Ducts shall be water-tight.
 - 2. Construct as follows to assure water run-off and no standing water.
 - a. Arrange standing seam, internal reinforcement, joints, flanges and access doors to prevent accumulation, ponding or pooling of water for both horizontal and vertical ductwork.
 - b. Locate longitudinal seams at bottom of duct.
 - c. Slope entire top of duct down toward sides. Coordinate duct slope with roof slope to avoid situations where roof slope and duct slope cancel each other out resulting in an unsloped top of duct.
 - d. Provide mastic within sheet metal joints.
 - 3. Installations and penetrations shall be in accordance with SMACNA Guidelines for Roof-Mounted Outdoor Air-Conditioner Installations.
 - 4. Provide sheet metal flashing or skirt at flexible connections to fans or HVAC units to avoid water accumulation.
 - 5. Coordinate exact duct routing and duct support locations on roofs with roofing contractor. Roof-mounted duct support details shall be approved by the roofing contractor and the Architect prior to fabrication and installation.
- F. Sound-Rated Duct Packing:
- 1. Wherever possible, avoid duct penetrations through sound-rated walls, floors and ceilings, in either Architectural elements or plenums specified under this Section.
 - 2. Provide packing specified in Section 23 33 19 – Acoustics for ducts penetrating sound-rated walls, floors or ceilings, and for unavoidable duct penetrations.
 - 3. Any interior walls, floors or ceilings that are internally insulated are considered sound-rated. Refer to Architectural Drawings for wall, floor and ceiling types.

3.2 ROUND AND OVAL DUCTWORK

A. Joints between ducts:

- 1. Construct with beaded sleeve joints.
- 2. Mechanically fasten with sheet metal screws or pop rivets except for fume exhaust, dust collection, clothes dryer ductwork.
- 3. Duct sealer shall be applied to male end and over all joint-, screw- and rivet-heads.

4. Seal as specified for rectangular ductwork.
- B. Joints, duct and fitting:
 1. Slip projecting collar of fittings into duct with a minimum insertion length of 2 inches.
 2. Apply duct sealer. Seal as specified for rectangular ductwork.
 3. Mechanical fastener schedule:

Duct Diameter	End Lap	No. of Rivets/Screws in Slip Joint
8 inches	0.75-inch	4
9 to 16 inches	1.00-inch	6
17 inches & up	1.25-inch	7 plus 3 per inch of circumference

- C. Junctions between ducts:
 1. Branch take-off: 45 degrees
 2. Branch take-off: conical 90 degrees
 3. Branch connections to unlined rectangular ducts may be made with spin-in fittings as specified
- D. Horizontal supports shall be one-piece clamp band strap, minimum one strap per section. Support fittings as required by SMACNA.
- E. Vertical supports shall be one of the following:
 1. Clamp bands with extended ends supported at each floor.
 2. Clamp bands with knee bracing.
 3. Pedestal at base of vertical riser.
- F. Use angle iron braces for duct reinforcing. Refer to the SMACNA HVAC Duct Construction Standards, Metal and Flexible, figure numbers 1-9 through 1-12.

3.3 FLEXIBLE DUCTWORK

- A. Provide continuous, single pieces.
- B. Maximum Length:
 1. Above 1-inch water gauge static pressure: 12 inches or as specified.
 2. Under 1-inch water gauge static pressure: 5 feet.
 3. Local codes or union rules take precedence and may reduce the maximum lengths specified.
- C. End Connections:
 1. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions.
 2. Secure with strap clamps specified above.
- D. Installation:
 1. Support per SMACNA.
 2. Flexible duct is not allowed in lengths greater than that specified. Bends, twists or sagging of flexible duct is not acceptable.
 3. Minimum inside bending radius shall be a minimum of two duct diameters. If minimum radius cannot be maintained, provide sheet metal plenum over air outlet and connect flexible duct to side of plenum. Paint interior flat black.
 4. Maximum – one 90-degree turn.
 5. Install as straight as possible.
- E. Flexible duct is only allowed above lay-in type accessible ceilings only.
- F. Flexible duct is not allowed to be used in lieu of rigid elbows or fittings.

3.4 DUCT HANGERS AND SUPPORTS

- A. General:
 1. Support horizontal ducts with hangers of size and spacing as indicated in SMACNA Duct Construction Standards.
 2. Attachment to structure shall be as specified in Section 23 05 29 – Hangers and Supports for HVAC.
 3. Vibration isolation and seismic restraints for ducts shall be as specified in Section 23 05 48 – Vibration and Seismic Controls for HVAC.
 4. Seismic restraints shall comply with SMACNA or UMC, whichever is more stringent.

B. Horizontal Duct Supports:

1. Install hangers at each change in direction of duct.
2. Strap hangers:
 - a. Extend strap down both sides of ducts.
 - b. Turn under bottom two inches minimum. Provide a minimum of 2 screws per side.
 - c. Screw hangers to bottom, upper and lower sides of ducts at 12 inches on center maximum.
 - d. Seal all screw penetrations of ductwork
3. Angle hangers:
 - a. Per SMACNA Guidelines for Seismic Restraints.
 - b. Seal all penetrations of ductwork
4. Support rectangular fume, vapor and grease exhaust ducts on angle hangers. Do not penetrate duct with fasteners.
5. Support circular fume, vapor and grease exhaust ducts with shop-rolled flat bar bands around duct.
 - a. Bands shall be 16-gauge by 1-inch steel minimum, hot dipped galvanized or prime coated after fabrication.
 - b. Fasten top to hanger rod and bolt bottom of bands.

C. Vertical Duct Supports:

1. Support vertical ducts at every floor.
2. Use angles or channels riveted to ducts. Seal all duct penetrations.
3. Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise noted.

3.5 PLENUM INSTALLATION

A. General:

1. Construct plenums with gauges, joints, bracing reinforcing, and other construction details in accordance with latest SMACNA, unless specified otherwise.
2. Construct with galvanized sheet metal of lock-forming quality.
3. Install hinged access doors where shown, specified, or required for access to equipment for cleaning and inspection. Minimum door dimension 60-inch by 18-inch with 12-inch by 12-inch minimum observation window, per SMACNA Figure 6-11 or Figure 6-12. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
4. Coat inside of plenums on discharge of air washers, humidifiers and spray coils with two coats of Bitumastic.
5. Slope floor to duct drain as specified.
6. Install sleeves and air-tight sealing grommets or resilient materials for all piping, conduit, tubing, wiring, shafts or other components penetrating plenum walls.
Sealing method shall allow movement of component penetrating the wall.

B. Sheet Metal Plenum Construction:

1. Galvanized sheet metal shall be 16-gauge, unless otherwise indicated:
 - a. Galvanized angle bracing riveted or bolted to sheet metal as required.
 - b. Panels shall be cross-broken.
2. Seams shall be 2-inch standing seams, 24 inches on center and staggered at adjacent panels.
3. Reinforcing shall be 2-inch by 2-inch by ¼-inch galvanized angles riveted or bolted to back of sheet metal and perpendicular to the standing seams.
4. Install angles at all floor, wall, and ceiling corners and around openings.
5. Fasten reinforcing components to floors, ceilings and walls on 16-inch centers. Seams and joints shall be sealed with mastic and made airtight.

C. Acoustical Panel Plenums:

1. IAC pre-fabricated plenum panels

3.6 MISCELLANEOUS INSTALLATIONS

- A.** Install the following equipment and materials furnished under other sections. Comply with manufacturer's installation instructions, code requirements, UL Listing and the requirements of local authorities.

1. Backdraft and balancing dampers
2. Fire, smoke, and fire/smoke dampers
3. Control dampers, automatic louver dampers
4. Filters
5. Sound traps
6. Air monitors and flow measuring devices
7. Access doors. Allow for adequate length of duct to install access door for all dampers
8. Smoke detectors, flow switches, controls and fire alarm devices
9. Pressure, temperature, humidity sensors/transmitters

3.7 DUCT AND PLENUM PRESSURE TESTING

A. Scope of Pressure Testing:

1. Test ductwork, including plenums, as scheduled below, for leaks. Pressure testing shall include applicable supply, return and exhaust systems.
2. Apply positive pressure test to all ducts intended to operate under positive pressure of 2 inches water gauge or greater, such as:
 - a. Supply ducts from fans to air outlets
 - b. Supply ducts from fans to air terminal units
 - c. Discharge ducts from exhaust fans outside
3. Apply Negative pressure test to all ducts intended to operate under negative pressure, such as:
 - a. Return ducts from air intakes to fans except on portions of duct exposed in spaces served by duct
 - b. Toilet exhaust ducts from air inlets to fans
 - c. General exhaust ducts from air inlets to fans

B. General:

1. Advise Architect at least 2 weeks in advance of testing so that test can be witnessed.
2. Use portable high-pressure blower and necessary instruments. Provide duct connections required for air flow and pressure testing.
3. Test before sections are concealed.
4. Furnish signed reports of results of tests to Architect.
5. Test Pressures shall:
 - a. 3 inches water gauge
 - b. 150 percent of scheduled static pressure for fan or unit.

C. Procedure:

1. Seal openings in ducts and plenums to be tested.
2. Connect test apparatus to test section using flexible duct connection or hose.
3. Close damper on blower suction side, to prevent excessive buildup of pressure.
4. Start blower and gradually open damper on suction side of blower.
5. Test for audible air leaks in ducts and plenums per referenced standards.
 - a. Repair and silence all audible leaks.
 - b. Do not retest until sealants have set.
6. Test for rate of air leakage in ducts and plenums per referenced standards. Determine amount of air leakage by make-up air flow measurements.
7. Repair air leaks as required and retest.
8. Visually mark tested sections with certification sticker and initials of field test inspector.

- D. Ductwork leakage rates shall comply with SMACNA "HVAC Air Duct Leakage Test Manual" for leakage Class 6 for rectangular ductwork, and leakage Class 3 for round ductwork.

3.8 DUCT CLEANING

A. Clean Duct Systems:

1. Force air at high velocity through duct to remove accumulated dust with high power vacuum cleaners .
2. Clean half system at a time.
3. Protect equipment, which may be harmed by excessive dirt with filters, or bypass during cleaning.
4. Provide adequate access into ductwork for cleaning purposes.
5. Seal all outlets dust tight. When closures are removed, avoid spilling dust inroom.
6. Where required, install 2-inch replaceable media filter in air outlets.

B. Repair any damage(s) resulting from duct-cleaning process.

END OF SECTION 23 31 13

SECTION 23 34 00 – HVAC FANS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The work on this section shall include, but is not limited to the following items:

1. Centrifugal Fans:
 - a. Scroll
 - b. Cabinet
 - c. Tubular Centrifugal
 - d. Plug (Unhoused Centrifugal)
2. Axial Fans:
 - a. Propeller
 - b. Vaneaxial – fixed blade
 - c. Vaneaxial – adjustable blade
 - d. Mixed Flow
 - e. Tube Axial
3. Backdraft Dampers for vaneaxial fans
4. Discharge Cones for axial fans
5. Roof Exhaust Fans
6. Variable Speed Dryer/Flue Vent/Combustion Fans
7. Ceiling/Wall Fans (Panasonic)

1.2 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- C. Section 23 05 14 – Variable Frequency Drives for HVAC
- D. Section 23 05 29 – Hangers and Supports for HVAC
- E. Section 23 05 48 – Vibration and Seismic Controls for HVAC
- F. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
- G. Section 23 31 13 – HVAC Ducts and Casings
- H. Section 23 33 13 – Dampers
- I. Section 23 33 19 – Acoustics
- J. Section 23 73 13 – Modular Indoor Central-Station Air-Handling Units
- K. Section 23 74 13 – Packaged Outdoor Central-Station Air-Handling Units

1.3 CODES AND REFERENCE STANDARDS

- A. Construct all fans, except vaneaxial adjustable blade, to comply with the requirements of the latest editions of the Air Moving and Conditioning Association (AMCA) Standards and Bulletins. Certify these fans by AMCA for performance and sound ratings and provide the AMCA Performance and Construction Seal for Air and Sound.
- B. AMCA – Air Movement and Control Association
 1. AMCA 99 Standards Handbook
 2. AMCA 203 Field Performance Measurement of Fan Systems
 3. AMCA 204 Balance Qualities and Vibration Levels for Fans
 4. AMCA 210 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance ratings
 5. AMCA 300 Reverberant Room Method for Sound Testing of Fans
- C. ABMA – American Bearings Manufacturers Association
 1. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings
 2. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings
- D. NFPA – National Fire Protection Association
 1. NFPA 90A Standard for the Installation of Air Conditioning and Ventilation Systems

2. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- E. UL – Underwriters Laboratories Inc.
 1. UL 705 Powered Ventilators
 2. UL 762 Powered Roof Ventilators for Restaurant Exhaust Appliances
- F. OSHA
 1. OSHA guideline 1910.212 – General Requirements for Machine Guarding
 2. OSHA guideline 1910.219 – General Requirements for Guarding Safe Use of Mechanical Power Transmission Apparatus

1.4 QUALITY ASSURANCE

- A. For each fan, provide a multi-speed fan performance curve with multiple horse-powers on a single sheet. Single-speed fan curves are not acceptable.
- B. Provide a full two-year parts and labor warrantee for all fan-mounted control air compressors.
- C. All components of exhaust fans used in smoke control systems shall be UL Listed and certified by the manufacturer for the probable temperature rise to which the components may be exposed, or a minimum of 200 degrees F continuous operation.
- D. All components of exhaust fans used in grease hood exhaust systems shall comply with NFPA 96 and be listed under UL 705 – Standard for Power Ventilators (UL motor, wiring components, UL approved guarding), and UL 762 – Power Ventilators for Restaurant Exhaust
- E. The maximum allowable fan vibration shall be 0.15 inches per second peak velocity, filter-in as measured at the fan RPM.

1.5 SUBMITTALS

- A. Submit construction details, gauges of fan wheels and housing components and certified dimensioned drawings.
- B. Submit manufacturer's latest published data for weights, materials, accessories and installation details.
- C. Submit full technical rating data based on tests in accordance with current AMCA standards and in an AMCA-approved laboratory. Fan curves shall indicate the relationship of airflow to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation shall also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.
 1. Include manufacturer's certified fan volume-pressure performance curves, from shut-off to free delivery. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.
 2. Include certified sound power ratings based on tests performed in accordance with AMCA 300. Correct all ratings and curves for altitude and temperature where applicable.
- D. Motor construction and efficiencies.
- E. Bearing life calculations based on maximum design speed for the class of each fan scheduled on the Drawing(s).
- F. Fan shaft critical speed at scheduled performance.
- G. For variable air volume application, include data that indicates the effect of capacity control devices, such as inlet vanes, on performance.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Centrifugal Fans: Twin City, Chicago, Howden, Loren Cook, Greenheck
- B. Propeller Fans: Twin City, Bayley, Woods, Loren Cook, Greenheck
- C. Axial Fans Fixed Blade: Twin City, Chicago, Loren Cook, Greenheck
- D. Axial Fans Adjustable Blade: Twin City, Woods, Joy, Loren Cook
- E. Roof Exhaust Fans: Penn, Loren Cook, Greenheck
- F. Mixed Flow Fans: Woods, Loren Cook, Greenheck
- G. Swing-out Centrifugal Fans: Twin City, Chicago, Loren Cook
- H. Clamshell Axial Fans: Twin City, Chicago, Loren Cook
- I. Cabinet Fans: Penn, Panasonic

2.2 GENERAL – ALL FANS

- A. Unless noted otherwise, provide discharge direction and drive arrangement to suit space conditions and conform as closely as possible to the layouts shown on the Drawings. Maintain clearance for service and access to all components.
- B. Provide factory-fabricated, -assembled, -tested, and -finished fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure. Fans shall be quiet operating and non-overloading over the entire range of operation.
- C. Provide fan motors in accordance with Section 23 05 13 – Common Motor Requirements for HVAC Equipment. Size motor to drive its respective fan when the fan is operating at a speed 5 percent in excess of that required to meet the scheduled fan performance. Do not select motors within the service factor for this range.
- D. Statically and dynamically balance fan wheels/impellers at the factory and certify balance. Design all vertically mounted fans to withstand the vertical thrust loads.
- E. Provide precision self-aligning bearings designed to prevent leakage of oil or grease. Provide cups, oil chambers, Zerk or Alemite lubrication fittings in accessible locations for ease of lubrication. Provide heavy-duty split pillow block bearings with tapered, double-row spherical roller assemblies. Provide bearings with ABMA L10 service life in excess of 200,000 hours at maximum published fan operating conditions for the AMCA construction class required unless noted or specified otherwise. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, to reduce vibration, increase service life and improve serviceability. Bearings that use set screws shall not be allowed.
- F. Provide copper or steel lubrication leads, for lubrication of internal motors and bearings, extending to a capped termination point external to the fan casing or air-handling unit.
- G. Extend wire leads on fans driven by direct motor drive from the motor junction box in airtight rigid walled conduit, to a junction box mounted external to the fan casing.
- H. On fans driven by belt drive, provide standard “V-groove” type oil-resistant, non-sparking, and non-static belts with cast iron or steel sheaves suitable for the service intended. Fan sheaves shall be non-adjustable type with removable machined bushings. Provide adjustable pitch type motor sheaves with double locking feature, to 10 percent above and below the rated fan speed. Dynamically balance sheaves with over three grooves. Belt drive shall be sized with a 1.5 service factor; provide sufficient quantity of belts and sheaves capable of carrying the entire load with one belt broken.
- I. Provide pre-formed expanded metal and sheet metal belt guards at the fan and motor shafts, for all exposed sheaves and belts. Guard shall comply with OSHA and SMACNA requirements; 0.1046-inch thick, ¾-inch diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short-circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- J. For motors in the airstream, provide TEFC type motors, unless other types are required, and as specified in Section 23 05 13 – Common Motor Requirements for HVAC Equipment.
- K. Provide solid hot-rolled steel drive shafts, machined and polished to a close tolerance where in contact with bearings. Secure fan wheels/impellers to the drive shaft by a key and keyway assembly. Shafts shall be sized for first critical speed and at least 1.43 times maximum speed for AMCA fan class. Shaft

length shall allow wheel adjustment of 4 inches.

- L. Manufacture fans of materials and paint finishes suitable for the service intended.
- M. Construct wheels/impellers exposed to normal atmospheres of cast aluminum or hot-dip galvanized steel and finished with two layers of factory-applied non-scaling paint.
- N. Construct fans exposed to corrosive atmospheres using all-welded construction of corrosion-resistant materials suitable for intended use, and factory-finished with epoxy or other approved corrosion-resistant coatings.
- O. Provide fans exposed to elevated temperatures with components rated for high temperature service. Do not use belt drive assemblies exposed to the airstream. Use direct drive motors certified for high temperature service.
- P. Use AMCA Type A spark-resistant construction for all fans handling flammable or grease-laden vapors, and use explosion-proof motors.
- Q. Electrically ground all fans and drives to prevent accumulation of static charge. Indicate grounding method in fan submittals.
- R. Provided threaded drain plugs at fan housing low points.
- S. Completely house fan assemblies exposed to weather in weather-proof enclosures including motor and drive.
- T. Fan wheels/impellers and housings shall be relieved of residual stresses produced in the forming process.
- U. Provide fans used to exhaust grease-laden vapors with motor drive and bearings completely external of airstream, and fan housings continuously welded inside and outside.
- V. Provide housings with integral inlet and discharge flanges, complete with bolt holes for flexible or hard duct connections. Shop-fabricate any companion flanges required for connections to sound attenuators. Companion flanges shall be rolled angles matched to both fan housing and sound attenuators.
- W. Provide parallel vane pre-rotation vortex vanes at the fan inlet for variable volume control. Vanes shall be steel blades supported at both ends with two permanently lubricated bearings. Variable mechanism shall terminate in single control lever with control shaft for double-width fans. Furnish and install all necessary linkages and accessories required for automatic control.
- X. Provide variable frequency drives as specified in Section 23 05 14 – Variable Frequency Drives for HVAC.
- Y. Provide gasketed access doors to permit routine maintenance and inspection of motor and internal components. Inside surface of access door shall be flush with the inside surface of the fan housing.
- Z. HVAC motors for fans that are less than 1 hp and 1/12 hp or greater are ECM or have a minimum motor efficiency of 70%. Motors also have means to adjust motor speed for balancing or remote control.

2.3 CENTRIFUGAL FANS

A. Scroll Type:

- 1. Provide backward inclined (BI), backward curved (BC), airfoil (AF), forward curved (FC) fan wheels, and single width single inlet (SWSI), or double width double inlet (DWDI), as specified or indicated on the Drawings, enclosed in a scroll-shaped fan housing with shaped cut-off and doors or panels to allow access to internal parts and components.
- 2. Weld or securely rivet fan blades to the hub plate and rim.
- 3. Fan housings:
 - a. Heavy-gauge construction, continuously welded inside and outside.
 - b. Housings shall be suitably braced to prevent vibration or pulsation and have spun, aerodynamically designed spun inlet cones or inlet venturis for smooth air entry into the wheels.
 - c. Fabrication Class: AMCA 99, Class I, or as shown on the Drawings.
 - d. Rotatable through eight discharge orientations.
- 4. All fan wheels shall have tapered spun wheel cones or shrouds providing stable flow and high rigidity. Housing with lock seam construction or partial weld shall not be acceptable unless for smaller fan sizes (12-inch wheel diameters or less) where it is standard construction for models listed on the Drawings.

B. Tubular Type:

1. Construct housing of welded rolled plate steel with reinforcing to prevent distortion. Provide each housing with a bolted and gasketed access door for inspection of drive and fan wheel.
2. Provide brackets suitable for horizontal or vertical mounting. Externally mount motors on an adjustable base.
3. Furnish with streamlined inlet cones and straightening vanes downstream of the fan wheel to minimize noise, reduce turbulence and to impart unidirectional airflow.
4. Match the wheel inlet ring to a close tolerance with integral deep-spun aerodynamic venturi inlets.
5. Use non-overloading airfoil blades welded to the wheel cones.
6. Continuously weld fan blades to the hub plate and rim. Backward inclined blades may be securely riveted to the hub plate and rim. Fan wheels shall be precision aluminum castings with machine finish.
7. Bearings shall be grease-lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation. Apply a second coat of paint to all exterior surfaces.
8. Isolate belt drives from airstream with a belt tube.

C. Cabinet Type:

1. Provide scroll type centrifugal fans, factory-installed within a cabinet enclosure, and comply with the requirements of Scroll Type Centrifugal Fans.
2. Internally isolate fan and motor assemblies from the cabinet.
3. Provide gasketed access doors and panels for inspection and routine maintenance of the internal components.
4. Provide solid state variable speed controllers for small ceiling-mounted direct driven exhaust and transfer fans.

D. Plug Type:

1. Single width, single inlet air foil type fan blades.
2. Plug fans shall have self-aligning pillow block bearings with minimum ABMA L10 life of 400,000 hours.
3. Plug fan plenums and inlet plenums shall be provided with an expanded metal door locked to prevent access to fan inlet, or a door switch hardwire-interlocked to automatically shut down fan operation.
4. An OSHA-compliant belt guard and shaft guard shall be included to completely cover the motor sheave and belts.

2.4 AXIAL FANS

A. Propeller Type:

1. Include propeller type impellers, complete with motors, and panel- or ring-mountings.
2. Vary fan blades in camber and twist from base to tip.
3. Construct impellers of die-formed steel or aluminum with a welded reinforcing gusset on the backside for added rigidity, attached to a central hub mounted on the fixed drive shaft. Fan shall be of welded and bolted construction utilizing corrosion-resistant fasteners.
4. Rotate fan hub on the fixed drive shaft using sealed ball bearings with a L10 life of 100,000 hours.
5. To eliminate overhang load on belted fans, design to apply belt load to the hub in the same plane as the bearings.
6. Direct drive fans are only acceptable where belt-driven units do not meet the performance criteria or direct drive is specified.
7. Provide panels or rings with spun venturi inlets suitable for wall-mounting and structural angle supports of welded steel construction.
8. Provide basket type fan guards for exposed inlets and discharges.
9. Provide TEFC motors on all fans.
10. Provide factory-fabricated wall sleeves.

B. Vaneaxial Fixed Blade Type:

1. Include impeller, motor, drive and cylindrical housing.
2. Replaceable fan blades shall have an airfoil cross-section, varying in camber and twist from base to tip, of die-formed steel or aluminum.
3. Fixed pitch fans shall have formed impeller blades and hub in a single precision casting, or precision-weld blades to the hub assembly.
4. Mount impeller directly on the drive shaft and secure in place with locking WP assembly. Design motor and impeller to be removable from the inlet side of the fan.
5. Cross brace motor support base on direct drive fans to the fan housing for structural rigidity and to prevent motor misalignment.
6. On belt drive fans, protect belts and bearings from the airstream in an air-insulated enclosure. Design to apply belt loads to the hub in the same plane as the bearings to eliminate overhang load.
7. Construct cylindrical fan housings of hot-rolled heavy-gauge rolled steel plate with continuous-weld seams.
8. Provide venturi inlet bell and discharge cone diffuser accessories of the same gauge and material as the fan housing.

C. Vaneaxial Adjustable Blade Type:

1. Include impeller and hub, guide vanes, motor, drive and cylindrical housing.
2. Construct fan blades of die-formed aluminum, sized for the fan diameter. Blades cut down from longer sections shall not be acceptable. Provide double thickness blades with airfoil cross-section and profile, varying in camber and twist, from base to tip.
3. Provide fans designated as adjustable pitch fans with blades which can be collectively manually adjusted in the field. Provide pitch indicators at the base of each blade. Secure blades in place with set screws or locking adjustment nuts. Fan shall be designed so that an AABC-certified balancing contractor can make adjustments in the field to both the blades' pitch and the limit control, and not compromise the safe operation of the fan or the manufacturer's warrantee.
4. Provide fans designed as controllable-pitch fans with in-flight blade pitch modulation. Vary blade pitch through an external actuator, connected via linkages to an internal, lubricated thrust-bearing assembly. Vary blade pitch in response to a command from an external control signal. Indicate blade angle on an external pitch-index plate. Furnish and install all necessary linkages and accessories required for automatic control. Provide limit control factory-set to the maximum performance blade angle to prevent under/over-pressurizing ductwork or motor overload and burnout. Upon fan shut-down or power failure, pitch shall be reset to the minimum setting. A pneumatic actuator furnished and mounted on the side of the fan casing by the fan manufacturer shall vary blade pitch in the controllable-pitch rotor. The actuator shall be electrically controlled by a remote signal from an external source to an electro-pneumatic transducer.
5. For direct drive units, mount impeller directly on the drive shaft and secure in place with locking WP assembly. Design motor and impeller to be removable from the inlet side of the fan.
6. Provide an aerodynamic spinner cap over the hub face of impellers, to protect and conceal blade adjustment bearings.
7. Guide vane assembly construction shall match that of the impeller assembly. The vane shape, camber and twist shall be optimized for airflow straightening into the fan and minimum aerodynamic inlet losses.
8. Cross brace motor support base and motor bearing on direct drive fans to the fan housing for structural rigidity to prevent motor misalignment. Cross braces shall not obstruct airflow.
9. On belt driven fans, protect belts and bearings from the airstream in an air-insulated enclosure. Design to apply belt loads to the hub in the same plane as the bearings to eliminate overhang load.
10. Construct cylindrical fan housings of hot-rolled heavy-gauge rolled steel plate with continuous-weld seams.

11. Provide venturi inlet bell and discharge cone diffuser accessories of the same gauge and material as the fan housing.
 12. Provide factory-mounted heavy-duty butterfly backdraft dampers manufactured by the fan manufacturer at discharge or inlet of fan or sound attenuator as appropriate to avoid interference with sound attenuators, routine maintenance and motor removal. Backdraft damper shall be suitable for continuous operation at 6,000 feet per minute face velocity.
 13. Butterfly type backdraft damper shall consist of vertically split and hinged steel plate assembly in a rolled steel flanged housing. In addition to backdraft performance, arrange mounting of hinged assembly to close by gravity when fan(s) are not operating.
 14. Provide companion flanges to receive backdraft damper, sound attenuators, sheet metal duct or flexible connectors. Companion flanges shall be of the same thickness as the fan flanges and provided by fan manufacturer.
- D. Mixed Flow Fans
1. Fan shall be of welded and bolted construction utilizing corrosion-resistant fasteners. Housing shall be minimum 12-gauge steel with integral inlet and outlet collars for slip fit duct connections.
 2. Wheel shall be steel, non-overloading, high efficiency mixed-flow type. Blades on all sizes shall be continuously welded to the backplate and inlet shroud. Hubs shall be keyed and securely attached to the fan shaft. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA 204, Balance Qualities and Vibration Levels for Fans.

2.5 ROOF EXHAUST FANS

- A. Provide roof exhaust fans of the centrifugal, belt-driven type. Construct fan housing of heavy-gauge aluminum.
- B. Construct all spun parts with a rolled bead for added rigidity and spun so as to seal the pores of the aluminum providing greater resistance against oxidation and deterioration.
- C. Provide all-aluminum fan wheel of the centrifugal blower type with backward inclined blades and a tapered inlet shroud. Statically and dynamically balance wheels.
- D. Provide inlet cone of aluminum centrifugal blower type.
- E. Enclose motor and drives in a weather-tight compartment separate from airstream and extend motor leads in metal conduit down through support base to facilitate wiring from below roof. Air-cool the motor using air uncontaminated by exhaust fumes.
- F. Provide motors of the heavy duty, permanently lubricated, sealed ball bearing type. Size drives for 150 percent of motor horsepower capabilities and of the cast iron type, keyed to the fan and motor shafts. Provide variable pitch drives, with a minimum of 2 belts.
- G. Construct fan shaft of steel construction, turned, ground and polished to precise tolerances in relationship to the hub and bearings.
- H. Provide drive belts of the oil-resistant, non-static, non-sparking type with an ABMA L10 life expectancy of minimum 24,000 hours.
- I. Provide flanged, permanently lubricated and sealed ball or roller type bearings.
- J. The entire drive and wheel assembly shall be removable as a complete unit from the support structure without disassembling the external fan housing. The assembly shall be hinged on one side with full-length weather-proof piano hinges. Mount the complete drive assembly on rubber vibration isolation.
- K. Provide direct drive fans of identical construction as belt drive fans, except for drives, belts, and fan shaft bearings.
- L. Construct all belt-drive fan interior and exterior parts, including wheel, wheel hub, supporting posts, fan shaft, drive assembly, and all outside fasteners, of aluminum or non-ferrous material. Include a five-year warranty.
- M. Provide a sound-attenuating roof curb with backdraft damper of the same manufacture as the roof exhaust fan.
- N. Up-blast fans shall have motor, bearings, and drives completely enclosed and isolated from the exhaust airstream with ventilation provided by outside air. Fans handling grease-laden vapors shall be UL Listed for conveying such vapors, operating continuously at 300 degrees.

2.6 SWING-OUT AND CLAMSHELL ACCESS

- A. Clamshell or swing-out fans shall provide access to the fan wheel and interior of the fan housing without removing the fan from ductwork. Quick-opening clamp latches shall allow the door to swing out on heavy-duty hinges to provide clear access, out of the airstream, to the fan wheel/impeller. Provide split inner cylinder to allow access to the bearings and shaft.
- B. Provide continuously welded heavy-gauge hinged access door in the fan housing operating with heavy-duty flanged ball bearings system for door support without the need for a truss.
- C. Bearings shall be rated at 200,000 hour L50 average life. Bearing cover plate shall be removable.
- D. Hand-operated T-handles shall seal doors airtight.
- E. On axial fans, one access door shall permit fan wheel removal.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install fans in accordance with manufacturer's recommendations and as shown on the Drawings. Follow SMACNA- and AMCA-recommended procedures for fan installations, belt guards, duct connections, etc.
- B. Provide flexible connections as described in Section 23 31 13 – HVAC Ducts and Casings with sufficient separation of ductwork, plenum panels, or air-handling unit casings from fan assembly to prevent metal-to-metal contact due to start-up torque or operating under specified isolator deflections.
- C. Install fans and motors with proper support and vibration isolation as specified in Sections 23 05 48 – Vibration and Seismic Controls for HVAC, and 23 05 29 – Hangers and Supports for HVAC.
- D. Provide sufficient clearances around fans for access and servicing of components. Install fans such that tachometer openings, access doors, motors, belts, lubrication lines, electrical connections, etc., are readily accessible and not obstructed by other installations or structures.

3.2 START UP

- A. Verify thermal-overload protection is installed in motors, starters, and disconnect switches. Verify proper motor rotation direction, fan wheel free rotation and smooth bearing operation. Align and adjust belts, install belt guards and verify lubrication for bearings and other moving parts. Verify that manual and automatic volume control and fire/smoke dampers in connected ductwork systems are fully open.
- B. Bump start fans to check that fan wheel/impeller has maintained static and dynamic balance and the rotation corresponds to the desired direction for airflow. Correct fans found to be rotating in a direction opposite to that desired. Unbalanced wheels shall be re-balanced by an AABC-certified test and balance contractor.
- C. Tighten belt drives, taking into account the service factor and any other design of the drive. Exercise care not to over-tension belts.
- D. Check all bolts and fasteners to ensure proper tightness. Do not over-tighten nuts and bolts.
- E. Check bearings and motor for proper lubrication, taking care not to over-lubricate. Use only lubricants recommended by the manufacturer.

3.3 FAN ACCESSORIES

- A. Provide the following accessories:
 - 1. Inlet cone, inlet bell, inlet box, inlet screen, inlet vortex breaker
 - 2. Outlet cone, outlet screen
 - 3. Support legs, hanger brackets welded to housing
 - 4. OSHA-approved belt guard
 - 5. Weather-proof motor and drive cover
 - 6. Shaft seal
 - 7. AMCA 99 Type C spark-resistant construction
 - 8. Threaded drain connection
 - 9. Backdraft damper
 - 10. Automatic spring-loaded belt tensioner on roof-mounted ventilators

- B. Provide a drain at the bottom of the housing for fans discharging upward from the roof. Pipe drains from housings of interior fans discharging directly up through the roof indirectly to a floor drain. Pipe drains from housings of kitchen grease exhaust fans to a grease interceptor.
- C. Provide 22-gauge wire mesh reinforced galvanized steel inlet and discharge guard screens for all fans or sound attenuators connected to fans without inlet or discharge ductwork.
- D. Shaft Cooler: For all smoke exhaust fans, provide metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- E. Provide shaft seal to reduce leakage and protect the bearings from contaminated airstream. Seal shall be constructed of non-asbestos woven fibrous materials (ceramic felt) compressed between an aluminum cover plate and the fan housing.
- F. Coatings: Two-coat hi-pro polyester topcoat with zinc epoxy basecoat. Greenheck "Perma-Z".
 - 1. Vinyl Coatings Groups II and VI: All vinyls shall be thermoplastic material and resistant to most organic and inorganic acids with medium concentrations and low temperature. Group II – Rustoleum 9000 Series; Group VI – Bisonite M, or equal.
 - 2. Epoxy Coatings Groups III-E, VII-S, VII-P and IX: Longer service life than conventional paint against mild acid of caustic solvent. Their resistant characteristics are similar to phenolic. Group III-E – Rustoleum 9100; Group VIIS– Plasite 7122; Group VII-P – Plasite 7133; Group IX – Coal Tar Epoxy; Bitumastic 300-M or Sherwin Williams Sher-Tar Epoxy or equal.
 - 3. Zinc Coating Group III-Z: Cold zinc coating applied as a spray shall provide better corrosion resistance than hot-dip galvanizing and high impact resistance. Zincilate Synthetic Resin Coating (Eisenheiss now called Sanitile) or equal.
 - 4. Group III-S: Low in cost and adequate in resistance to severe acidic and alkaline conditions makes this coating popular for evaporative cooling and other air conditioning equipment. Sanitile or equal.
 - 5. Phenolic Coatings Groups IV and VIII: Good resistance to high concentrations of organic or inorganic acids with the exception of strong oxidizing agents, i.e., nitric and chromic. Resistant to only low-concentrated alkalis, but excellent solvent resistance. Not recommended for hydrofluoric acid or hypochlorite salts. Airdried phenolic will have shorter life than baked phenolic. Heresite baked phenolic is most effective while handling dust and explosive gases. Group IV –Heresite VR500; Group VIII – Heresite P-403, P-4403 or equal.

END OF SECTION 23 34 00

SECTION 23 37 00 – AIR OUTLETS AND INLETS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include the following types of air source heat pump units and associated controls:
 - 1. Air outlets
 - 2. Air inlets
 - 3. Accessories for air inlets and air outlets
 - 4. Specialty air distribution devices
 - 5. Refer to Architectural Drawings and Specifications for floor, wall and ceiling construction.

1.2 REFERENCE STANDARDS

- A. ANSI – American National Standards Institute
 - 1. ANSI S1.13 – Measurement of Sound Pressure Levels in Air
- B. AHRI (ARI) – Air Conditioning and Refrigeration Institute Standards:
 - 1. AHRI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
 - 2. AHRI 880 – Air Terminals
- C. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers
 - 1. ASHRAE 70 – Method of Testing the Performance of Air Outlets and Air Inlets
 - 2. ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
 - 3. ASHRAE 113 – Method of Testing for Room Air Distribution
- D. ASTM – American Society for Testing and Materials
 - 1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 2. ASTM D870 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersions
 - 3. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
 - 4. ASTM D3776 – Standard Test Methods for Mass per Unit Area (weight) of Fabric
- E. NFPA – National Fire Protection Association
 - 1. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems

1.3 QUALITY ASSURANCE

- A. Air outlets and inlets shall be tested in accordance with:
 - 1. AHRI 880 – Air Terminals
 - 2. AHRI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
 - 3. ASHRAE 70 – Method of Testing the Performance of Air Outlets and Air Inlets
 - 4. ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
 - 5. ASHRAE 113 – Method of Testing for Room Air Distribution
- B. All air inlets and outlets shall be factory-painted or -anodized. Paint or anodized finish shall pass a 100-hour ASTM B117 test. The finish shall pass a 250-hour ASTM D870 test and an ASTM D2794 impact test. Finish (pencil) hardness shall be minimum HB to H.
- C. For all components provided with fiberglass acoustic lining, refer to Section 23 07 00: HVAC Insulation

1.4 SUBMITTALS

- A. Submit manufacturer's performance data including air throw and drop, outlet velocities, total and velocity pressures and acoustic performance.
- B. Submit manufacturer's specifications of construction including materials, installation instruction and adjustment data. Include "K" factors for balancing, if available.
- C. Submit product accessories.

- D. Submit samples, color and finish selections, schedule of sizes and model number for review by the Architect prior to fabrication.
- E. Schedule of air outlets and air inlets indicating drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2– PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Drawings and schedules indicate specific requirements of air inlets and air outlets and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal quality, appearance, finish and performance characteristics may be considered. Refer to Section 23 05 01 – HVAC General Provisions for alternates or substitutions.
- B. Air Inlets and Outlets: TRUAIRE (Residential), Titus, Price, Krueger, Air Factors, Air Concepts, Halton.
- C. Accessories: Dampers, equalizing grids, turning vanes, extractors, plenums, hardware and frames shall be provided by the same manufacturers as the air inlets and air outlets provided.

2.2 GENERAL

- A. Air distribution outlets as shown on the Drawings shall accommodate the air volume and throw indicated to maintain a maximum terminal velocity of 50 feet per minute in the occupied area. The overall noise level produced by all of the supply air outlets and exhaust or return air inlets in various rooms shall not exceed specified limits..
- B. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling types and construction. Air outlets and inlets in fire-rated ceilings or walls shall be all-steel construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.
- C. All dampers provided shall be operable from the face of the Air Inlet or Air Outlet.

2.3 AIR OUTLETS – SUPPLY CEILING DIFFUSERS (CD)

- A. Square Ceiling Diffuser, Perforated Flush Face:
 - 1. Provide perforated face star pattern supply diffuser, steel construction with removable/stationary deflectors and AG-75 damper mounted in the neck of the diffuser.
 - 2. Perforations in diffuser face shall be 3/16-inch diameter on ¼-inch staggered centers with a minimum of 51 percent free area.
 - 3. Deflectors shall provide horizontal air pattern towards the corners of the diffuser.
 - 4. Backpan shall be one-piece stamped steel with screw locator dimples to allow field adjustment of airflow pattern.
 - 5. The star deflector shall be one-piece steel construction mounted in the diffuser neck and include a center opening for damper access.
 - 6. Sizes indicated on the Drawings are neck sizes. Provide a 1.125-inch neck length to accommodate duct connections.
 - 7. Air pattern shall be as indicated on the Drawings or provide factory-set air pattern for a 4-way “star” airflow.
 - 8. Provide the correct border type to accommodate the ceiling type as specified or shown on the Architectural Drawings.
 - 9. Baked white enamel outer finish and black inner finish.
 - 10. Type CD-A: 24-inch by 24-inch face size. Titus Model PSS, Price PDSP or approved equal.
- B. Square Ceiling Diffuser, Plaque Face:
 - 1. Provide plaque face supply diffusers, all-steel construction with AG-75 steel opposed blade volume control damper.
 - 2. The diffuser shall have a 22-gauge steel face panel that captures a secondary 22-gauge panel. The face panel is removable by means of four hanger brackets. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners.
 - 3. The face panel shall project ¼ inch below the outside border of the diffuser backpan. The back of

the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. The diffuser neck shall have a minimum of 1¼-inch depth available for duct connection.

4. Sizes indicated on the Drawings are neck sizes.
 5. Baked white enamel finish.
 6. Type CD-C: 24-inch by 24-inch face size. Titus Model OMNI, Price SPD or approved equal.
 7. Type CD-D: 12-inch by 12-inch face size. Titus Model OMNI, Price SPD or approved equal.
- C. Square Ceiling Diffuser, Louver Face Multi-Pattern:
1. Provide louver face supply diffusers, all-steel construction with AG-95 steel opposed blade volume control damper and adjustable discharge pattern control vanes.
 2. Diffuser shall consist of an outer frame assembly with a square, rectangular or round inlet (using a transition duct fitting), and a removable inner core assembly of fixed deflection louvers.
 3. Provide adjustable vanes for full vertical and horizontal projections. Removable throw-reducing vanes shall be provided to deflect horizontal discharge into diverging airstreams.
 4. Sizes indicated on the Drawings are neck sizes.
 5. Air pattern as indicated on the Drawings.
 6. Baked white enamel finish.
 7. Type CD-E: Titus Model TDCA, Price SMDA or approved equal.
- D. Square Ceiling Diffuser, Louver Face Fixed Pattern:
1. Provide louver face supply diffusers, all-steel construction with AG-75 steel opposed blade volume control damper.
 2. Diffuser shall have three one-piece precision die-stamped cones to provide uniform appearance if different neck sizes are used. The back cone shall include an integral drawn inlet. The two inner cones shall be a removable assembly with adjustable vanes to change the airflow from fully open to fully closed.
 3. Sizes indicated on the Drawings are neck sizes.
 4. Baked white enamel finish.
 5. Type CD-F: 24-inch by 24-inch face size. Titus Model TMSA, Price SCDA or approved equal.
- E. Round Ceiling Diffuser:
1. Provide round face diffusers, all-steel construction with AG-75 steel opposed blade volume control damper.
 2. Diffusers shall have four cones and round neck, constructed of minimum 18 gauge steel.
 3. The airflow discharge pattern shall be field-adjustable by extending or retracting the three inner cones with adjusting screws.
 4. The three inner cones shall be an easily removable assembly using a spring lock mechanism. Provide safety chain.
 5. Sizes indicated on the Drawings are neck sizes.
 6. Baked white enamel finish.
 7. Type CD-G: Titus Model TMRA (Type 1), Price RCD or approved equal.
- F. Round Ceiling or Sidewall Diffuser:
1. Provide round face diffuser with adjustable concentric conical rings, round neck, all-steel construction with steel opposed blade volume control damper.
 2. Rings shall be adjustable through 120-degrees spherical throw direction.
 3. Sizes indicated on the Drawings are neck sizes.
 4. Baked white enamel finish.
 5. Type CD-H: Air Concepts Model ANC or approved equal.

2.4 AIR OUTLETS – SUPPLY REGISTERS (SR)

A. Exposed Duct Double Deflection Supply Register::

1. Provide steel border register with rear vertical and front horizontal adjustable air foil type solid aluminum blades.
2. Provide model AG-35 steel opposed blade volume control damper, model AG-45 extractor and install register on a reverse knuckle joint in accordance with SMACNA Manual.

3. Frames shall be 1.25 inches wide, 20 gauge steel with full penetration resistance welds and a steel reinforcement gasket at each corner. Grind welds smooth and countersink all screw holes.
 4. Aluminum blades shall be spaced on 0.75 inch centers and extend completely through the side frame on each side. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with permanently spring tensioned wire.
 5. Baked white enamel finish.
 6. Type SR-A: Titus Model 272 RL or approved equal.
- B. Sidewall Double Deflection Supply Register:
1. All aluminum register with rear vertical and front horizontal adjustable air foil type blades.
 2. Provide model AG-35-AA aluminum opposed blade volume control damper, model AG-45 extractor, and Type PF mounting frame.
 3. Frames shall be 1.25 inches wide by 0.05-inch thick aluminum, interlocked at the corners and mechanically staked to form a rigid frame with flush joints and countersunk screw holes.
 4. Aluminum blades shall be spaced on 0.75-inch centers and extend completely through the side frame on each side. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with permanently spring tensioned wire.
 5. Baked white enamel finish.
 6. Type SR-B: Titus Model 272 FL or approved equal.
- C. Sidewall Stair Pressurization Register:
1. Provide extruded aluminum register with horizontal fixed blades (no vertical adjustable rear blades), aluminum opposed blade volume control damper, gasketed frame with concealed screw fastening.
 2. Baked enamel finish.
 3. Type SR-C: Titus Model 1700 or approved equal

2.5 AIR OUTLETS – LINEAR DIFFUSERS (LD)

- A. Linear Supply Diffuser, Bar Type:
1. Provide extruded aluminum linear diffuser for floor, sill or sidewall application.
 2. Fixed bars [¼-inch] [⅛-inch] [7/32-inch] thick and parallel to the long dimension, locked into an extruded aluminum border. Provide rear support bars parallel to the short dimension on maximum 9-inch centers or 6-inch centers for floor application.
 3. Air deflection shall be [0 degrees] [15 degrees].
 4. Bar spacing shall be [¼ inch] [½ inch] [7/16 inch].
 5. Provide one-piece diffuser lengths up to 6 feet. Longer lengths shall be joined with alignment strips and pins to form a continuous appearance with all joints flush.
 6. Provide diffuser length, width, air volume, border type, frame type and fastening method as shown on the Drawings.
 7. Clean anodized finish.
 8. Type LD-A: Titus Model CT –[580]
- B. Linear Supply Diffuser, Slot Type:
1. Provide extruded aluminum linear diffusers with steel pattern controllers.
 2. Slot width shall be [½ inch] [¾ inch] [1 inch].
 3. Provide one-piece diffuser lengths up to 6 feet. Longer lengths shall be joined with alignment strips and pins to form a continuous appearance with all joints flush.
 4. Number of slots, lengths, air volume, border type, frame type, and fastening or mounting type as indicated on the Drawings.
 5. The pattern controller shall be an aerodynamically curved “ice-tong” shaped steel deflector capable of 180-degree pattern adjustment from the face of the diffuser and shall accommodate dampering as required. Maximum pattern controller length shall be 3 feet. Provide multiple sections as required over the full active length of the diffusers.
 6. Clear anodized finish.
 7. Type LD-B: Titus Model ML FL – [37] [38] [39]10.

2.6 INLET TYPES

A. Ceiling Perforated Register:

1. Provide all-steel construction with Titus model AG-75 steel opposed blade damper.
2. Flush perforated face shall be an exact match in construction, mounting type and appearance to the perforated face air outlets as specified.
3. Perforated face shall be easily unlatchable from the back pan.
4. Face area as shown on the Drawings.
5. Baked white enamel finish.
6. Type ER-A: Titus Model PAR.

B. Louvered Register:

1. Provide all-aluminum register for sidewall or ceiling return or exhaust.
2. The single extruded aluminum set of horizontal fixed blades shall be set at 45-degree fixed deflection on $\frac{3}{4}$ -inch spacing. Blades shall be secured from behind by welding to fixed mullions. Provide a model AG-35 steel opposed blade damper.
3. The extruded aluminum border shall be 0.05 inches thick and 1.2 inches wide, interlocked and mechanically staked at the four corners to form a rigid frame. Corner joints shall be flush and screw holes shall be countersunk.
4. Baked white enamel finish.
5. Type ER-B: Titus Model 3FL.

C. Ceiling Perforated Grille:

1. Provide all-steel construction. Face area as shown on the Drawings.
2. Flush perforated face shall be an exact match in construction, mounting type and appearance to the perforated face air outlets as specified.
3. Perforated face shall be easily unlatchable from the back pan.
4. Face area as shown on the Drawings.
5. Baked white enamel finish.
6. Type EG-A: Titus Model PAR.

D. Louvered Return Grille:

1. Return grille shall be used for sidewall or ceiling return or exhaust. All-aluminum construction with one set of horizontal fixed blades, set at 45-degree fixed deflection, $\frac{3}{4}$ -inch spacing.
2. Baked enamel finish.
3. Type EG-B: Titus Model 3FL.

E. Door Mounted Transfer Grille:

1. Provide door-mounted grilles of minimum 20-gauge all-steel construction.
2. Blades shall be inverted "V" shaped to provide sight-proof design and stiffness. Corners shall be all welded, ground smoothed and reinforced with gussets. Countersink screw holes.
3. Verify all sizes as shown on the Drawings or shown on the Architectural door schedule.
4. Type EG-C: Titus Model T-700.

F. Eggcrate Return Grill:

1. Provide eggcrate design with $\frac{1}{2}$ -inch by $\frac{1}{2}$ -inch by $\frac{1}{2}$ -inch aluminum grid with a minimum free area of 90 percent.
2. Provide with [surface mount] [lay-in tile] extruded aluminum border, 1.25 inches wide, 0.05 inches thick with flush joints and countersunk screw holes.
3. Face areas as shown on the Drawings.
4. Baked enamel finish.
5. Type EG-D: Titus Model 50F.

PART 3– EXECUTION

3.1 GENERAL

- A. Drawings indicate general arrangement of ducts, fittings, and accessories to achieve air volume, noise criteria, airflow pattern, throw, and pressure drop. Locations indicated on the Architectural drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

3.2 INSTALLATION

- A. Install air outlet and air inlet with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- B. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.
- C. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions.
- D. All visible interior surfaces of air inlets shall be factory-painted flat black.
- E. All visible exterior surfaces of air inlets or outlets shall be factory-painted in a color as selected by the Architect.

END OF SECTION 23 37 00

SECTION 23 74 24 – PACKAGED ROOFTOP UNITS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work of this Section shall include, but is not limited to, the roof top units on the project.
- B. Provide outdoor rooftop make-up air units with:
 - 1. [Weather hood with bird screen, intake filters, heater sections, horizontal discharge configuration
 - 2. [Roof curb: 14-inch high insulated W/ isolators]
 - 3. Spring vibration isolation and seismic restraint of blower
 - 4. Service receptacle
 - 5. Filter gauge with pilot light
 - 6. Duct-mounted smoke detector
 - 7. Duct liner insulation of casing
 - 8. Time delay relay
 - 9. Discharge temperature control with space temperature override
 - 10. Automatic inlet damper with end switches
 - 11. DX Heating and Cooling coils

1.2 REFERENCE STANDARDS

- A. AMCA – Air Movement and Control Association
 - 1. AMCA 99 Standards Handbook
 - 2. AMCA 203 Field Performance Measurement of Fan Systems
 - 3. AMCA 204 Balance Qualities and Vibration Levels for Fans
 - 4. AMCA 210 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Ratings
 - 5. AMCA 300 Reverberant Room Method for Sound Testing of Fans
 - 6. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data
- B. ABMA – American Bearing Manufacturers Association
 - 1. ABMA 9 Load Ratings and Fatigue Life for Ball Bearings
 - 2. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings
- C. AHRI (ARI) – Air Conditioning and Refrigeration Institute Standards
 - 1. ARI 410 Forced-Circulation Air-Cooling Air Heating Coils
 - 2. ARI 430 Standard for Central Station Air-Handling Units
- D. FM – Factory Mutual
- E. NFPA – National Fire Protection Association
 - 1. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilation Systems
- F. UL – Underwriters Laboratories Inc.
 - 1. UL 181 Factory-Made Air Ducts and Air Connectors
 - 2. UL 900 Air Filter Units
 - 3. UL Heating and Cooling Equipment
- G. NEC – National Electric Code
- H. CBC – California Building Code
- I. CMC – California Mechanical Code

1.3 QUALITY ASSURANCE

- A. Construct units in compliance with all requirements of the latest edition of the AMCA certified rating standards 300 and 301 for air-moving equipment: Air and Sound.
- B. Test, rate and certify units' performance and characteristics, including burner, in accordance with ARI.
- C. Provide UL Listed unit
- D. Sound Ratings: Construct each direct-fired make-up air unit to operate for conditions of the airflow for installation and sound environment as specified in Specification Section **23 13 39** – Acoustics.
- E. In order to establish centrifugal fan test curves, test each type of unit in accordance with AHRI 430-99
- F. Maximum allowable air leakage shall be 1.4 percent of design airflow at 4 inches static pressure for the direct-fire make-up air unit as installed.
- G. Gas train shall be Factory Mutual approved.

1.4 SUBMITTALS

- A. Manufacturer's Data: Submit certified dimensioned drawings, including total weight and support points.
- B. Product Data: Submit fan curves, cooling performance, heating performance, and acoustical data for each unit, control sequences and wiring diagrams.
- C. Construction Details: Access doors, roof curb, casing, frame, component mounting arrangements and brackets, connection details, hardware.
- D. Refer to each Section listed above in Paragraph 1.02 – Related Documents for additional submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Rooftop Units: Carrier, York, Daikin, CaptiveAire
- B. Fan Wheels and Housings, Dampers, Vibration Isolation, Filters, Gauges, Motors, Hardware: Refer to each individual specification section listed above in Paragraph 1.02 –Related Documents.

2.2 GENERAL

- A. Provide factory-built heat pump make-up air units of the horizontal or roof-mounted type with performance requirements and capacities as shown on the Drawings. Make-up air unit shall be a centrifugal blow-through configuration.
- B. Construct each make-up air unit complete with base rails, casings, fans, internal springtype vibration isolation, seismic restraints, insulation, DX Heating/cooling coils, access doors, lights, filters, control dampers, galvanized or painted filter retainer frames or plenums for filter holding frames and media, factory-mounted fan motors with adjustable bases, belt guards, and belt drives. Unit shall be completely packaged unit including all necessary controls of fan, and discharge air temperature.
- C. Provide an intake weather hood constructed of 16-gauge galvanized steel with galvanized bird screen.

2.3 UNIT CASINGS

- A. Construct each unit with an air-tight sectionalized casing of “lock forming” quality galvanized steel, phosphatized steel, or bonderized steel. Finish phosphatized or bonderized metal with rust-inhibiting paint. For maximum rigidity, properly reinforce casing and brace with steel angle framework with the same finish as the unit casing. Provide suitable continuous gaskets at all joints between casing sections. Provide stiffeners, if required, to prevent unit casing pulsation or oil-canning. Each section shall be modular with identical height, width, and continuous pre-punched matching mating flanges.
- B. Completely enclose all connections.
- C. Furnish access doors, minimum six square feet in size, in all sections. Equip doors with Ventlok Style 140 latch and Ventlok Style 150 hinges. Locate doors so that the unit may be inspected or entered regardless of mounting arrangement. Separate door insulation from unit insulation and secure and seal as specified for unit casing insulation. Locate access doors on the most accessible side of the air-handling unit as it is installed on this Project. Equip fan section access door with Ventlok 157 continuous full height piano hinge. For section access door, width shall permit removal of fan motor.
- D. Internally insulate unit casings with 2-inch thick, 1.5-pound density fiberglass. Cover all exposed parts such as angles, braces, etc., in contact with exterior surfaces with insulation in such a manner to prevent condensation on any surface. Install insulation in such a manner as not to be disturbed if panels are removed. Secure insulation to the casing surfaces and framework with adhesive over entire surface and stik-clips, grip nails or weld pins with fasteners. Protect the insulation from delamination or fretting by coating edges with adhesive or mastic. Exposed fiberglass shall not be allowed. Insulation shall meet the erosion requirements of UL 181 facing the air stream. Refer to Section 23 07 00 – HVAC Insulation for additional requirements.

2.4 FAN, SHAFT AND DRIVE ASSEMBLIES

- A. Provide double width, double inlet, multi-blade centrifugal fans with either air foil blades, forward-curved blades, or backward-inclined blades as indicated in the schedule by model or type of fan.
- B. Factory-assemble fans, sheaves, motors and belts on or within the fan section casing. Supply balanced fans, motors and sheaves. After the factory-assembly of the fan, motor and drive, balance make-up air unit fans, bearings and sheaves to meet AMCA 204Units shipped without motors and drives completely assembled shall not be acceptable.
- C. Provide precision self-aligning bearings designed to prevent leakage of oil or grease. Provide cups, oil chambers, Zerk or Alemite lubrication fittings in accessible locations for ease of lubrication. Provide heavy-duty split pillow block bearings with tapered, double-row spherical roller assemblies. Provide bearings with ABMA L10 service life in excess of 200,000 hours at maximum published fan operating conditions for the AMCA construction class required unless noted or specified otherwise.
- D. Provide copper lubrication leads, for lubrication of internal motors and bearings, extending to a capped termination point easily accessible from the fan section access door without entering the unit.
- E. Select fan drives with a minimum belt capacity of 200 percent of the motor nameplate horsepower. Provide the fan drive components as follows:
 - 1. Provide adjustable sheave for make-up air units based on the required speed. Select motor sheave for the rated fan rpm as determined by the fan capacity requirements scheduled and be adjustable as close to 10 percent above and below the rated fan speed as possible.
 - 2. After correct speed has been determined with the variable sheave, furnish and install fixed sheaves on all units that require more than two belts.
- F. Provide belt guards for all fan drives. Guards shall conform to the contour of the drive assembly. Material, construction, and finish of the guard shall be similar to that of the unit casing. Guards shall be braced and fastened so that objectionable vibration will not occur. Provide tachometer openings at least 2 inches in diameter for checking fan and motor speeds. Tachometer hole must align with the shaft. Two-section fan guards shall be designed in such a manner that either section can be removed without removing the adjacent section. When fan drive is internal to the beltguard may be eliminated if a warning sign is factory-provided warning of open drive in unit.
- G. Motors shall be selected so that they will not overload if the static pressure drops ¼-inch below the specified value. Motors shall be mounted on the burner connection side unless indicated otherwise on the Drawings. Each motor shall be factory-mounted on an adjustable base rigidly supported on the fan base frame. Refer to Section 23 05 13 –Common Motor Requirements for HVAC Equipment and Section 23 05 – HVAC Fans.

2.5 SMOKE DETECTOR

- A. A photoelectric smoke detector shall be supplied by the unit manufacturer for mounting in the discharge of each unit. The smoke detector shall immediately shut down the fan and activate the fire alarm system when activated.

2.6 CONTROLS

- A. Units shall be provided with a control compartment. All controls mounted within this compartment shall be wired to a numbered terminal strip. All wiring shall be color-coded and in accordance with NEC. A circuit diagram of the approved electrical drawing shall be provided with the unit. All electrical components shall bear the UL label.
- B. Unit controls shall consist of a spark ignition or hot surface ignition system with flame sensing, high temperature limit switch set at 185 degs F, timed freeze protection (factory set at 45 degrees with a three-minute time delay) flame safeguard with alarm contacts, ignition transformer, air proving differential switch.
- C. Control panel shall also contain main master unit disconnect switch, fan starter, overloads and control circuit fuses.
- D. Time Freeze Protection shall consist of an on-off discharge duct stat and timer. Prevents continued discharge of cold air if unit heating is not functioning. Factory set at 45 degs F. If the discharge air temperature is below 45 degs F, 3 minutes after heating is first called to come on, the unit shall shut off. The timer's purpose is to keep the thermostat from shutting off during the purge cycle.
- E. Unit heating and cooling output shall be controlled based on a discharge air sensor with adjustable temperature setpoint.

2.7 FILTER SECTION

- A. Galvanized or painted filter sections and retainer frames for Type "B" filters, or plenums for filter-holding frames for Type "A" filters, shall accommodate the specified or scheduled air filter media at maximum filter face velocity of 500 feet per minute.
- B. Refer to the Drawings and Section 23 40 00 – HVAC Air-Cleaning Devices.
- C. Maximum length of filter section casing shall be 30 inches for bag filters and 16 inches for flat filters.

2.8 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

- A. Refer to the Drawings and Specification Section 23 05 48 – Vibration and Seismic Controls for HVAC.

2.9 DAMPERS

- A. Provide motorized opposed blade outside air dampers with electric two-position spring return damper actuator and limit switches to indicate damper open or closed.

2.10 COOLING COIL

- A. Cooling coil shall be copper tube with aluminum fins with coil connections capped outside the make-up air unit casing.
- B. Extend the drain pans under the complete coil section including access and plenum sections between multiple coils. Pan shall extend a minimum of 15 inches downstream and 9 inches upstream beyond face of coil and be a minimum of 2 inches deep. Pan shall be rigid and water-tight with threaded pipe drain connection extended out the side of the unit and capped. Slope drain pan a minimum of 0.25 inches per foot in two directions to the drain connection. Provide drain pans of the double pan insulated type, with a 16-gauge Type 304 stainless steel inner pan and a 16-gauge galvanized steel outer pan. Provide UL Listed insulation 2-inch thick high-density fiberglass, cemented and vapor-sealed between the inner and outer pan. Provide intermediate drain pans for coil sections over 48 inches in height.

PART 3 – EXECUTION

- 3.1** Provide continuous 10-gauge galvanized steel base rail for entire length of each side of all makeup air units with intermediate cross members as required.
- 3.2** All mating flanges shall bolt together with bolt holes spaced a maximum of 10 inches. All mating flanges shall be gasketed and extend around full perimeter of each casing section.
- 3.3** Provide flexible connection for all fans and external duct connections. Support connecting ductwork or sound attenuators independent of the make-up air unit. Refer to Section 23 31 13 –HVAC Ducts and Casings.
- 3.4** Provide air-tight grommets for all casing penetrations such as coil connections, electrical conduit for power and control wiring, grease tubing, etc. Extend all such connections from inside the air-handling unit to an accessible location.
- 3.5** Provide additional blank access sections as required to coordinate supply, and outside air duct connections locations with ductwork shop drawings submittals.

END OF SECTION 23 74 24

SECTION 26 01 00 – SPECIAL REQUIREMENT

PART 1 – GENERAL

1.1 AUXILIARIES AND ACCESSORIES

Include all auxiliaries and accessories for complete and properly operating systems.

- A. Provide and install all electrical systems and any necessary accessories as per CEC and local codes whether specified herein or shown on drawings or not. The content of these specifications (Division 26) and contract documents in general only refer to work required above and beyond the requirements of the CEC and applicable local codes.

1.2 AUXILIARIES AND ACCESSORIES

Include all **auxiliaries** and accessories for complete and properly operating systems.

- A. Provide and install all electrical systems and any necessary accessories as per CEC and local codes whether specified herein or shown on drawings or not. The content of these specifications (Division 26) and contract documents in general only refer to work required above and beyond the requirements of the CEC and applicable local codes.

1.3 COORDINATION

- A. Lay out before installation so that all trades may install equipment in spaces available. Provide coordination as required for installation in a neat and workmanlike manner
- B. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor.
- C. Locate all openings required for work performed under this section. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.

1.4 BASIS FOR WIRING DESIGN

- A. The drawings and specifications describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.).
- B. Wherever the contractor provides power consuming equipment which differs from drawings and specifications, the wiring and associated circuit components for such equipment shall be changed to proper sizes to match.
- C. Changes of more than two breaker overload ratings or two cable sizes up or down shall be reviewed by the Engineer.

1.5 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets; conduit, panels, etc. shall have factory finish.

1.6 MATERIALS

- A. Where several brand names, makes or manufactures are listed as acceptable, each shall be regarded as equally acceptable. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the component shall meet nationally (U.S.) recognized standards and local codes.

1.7 TECHNICAL INFORMATION BROCHURES AND SUBMITTALS

- A. Submit Technical Information Brochures no less than 60 days before approval is needed. Each brochure shall consist of an adequately sized, hard-cover, 3-ring binder for 8 1/2" x 11" sheets. Provide correct designation on outside cover and on end of brochure. When, in the judgment of the Architect, one binder is not enough to adequately catalog all data, an additional binder will be required and data split as directed by the Architect.
- B. First sheet in the brochure shall be an index page listing all equipment contained in the brochure which pertains to the project.
- C. Provide reinforced separation sheets tabbed with the appropriate specification reference and typed index for each section.
- D. All submittals that contain details, components, or options that do not apply shall be clearly marked via arrows, clouds, cross-outs, etc. to indicate what is being furnished.
- E. Technical Information consisting of marked catalog sheets or shop drawings shall be inserted in the brochure in proper order on items herein specified or shown on drawings.
- F. Shop Drawings
 - 1. Drawings shall include identification of project, and names of Architect, Architect, General Contractor, Subcontractor, and/or supplier, data and numbered sequentially and indicated in General.
 - a. Fabrication and Erection dimensions.
 - b. Arrangements and sectional views.
 - c. Necessary details, including complete information for making connections with other work.
 - d. Kinds of materials and finishes.
 - e. Descriptive names of equipment.
 - f. Modifications and options to standard equipment required by the contract.
 - g. Leave blank area, size approximately 4 by 2-1/2 inches near the title block (for Architect's stamp imprint).
 - h. In order to facilitate review of drawings, in so far as practical, they shall be noted, indicating by cross reference the contract, drawings, notes, and/or specification paragraph numbers where item(s) occur in the contract documents.
 - i. See specific sections of specifications for further requirements.

- G. Product Data

1. Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
2. In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where item(s) occur in the contract documents.
3. See specific sections of specifications for further requirements.

H. Samples

1. When requested, furnish two samples of materials or equipment. Accompany samples with a copy, in duplicate, of manufacturer's instructions regarding installation, finishing and maintenance.

1.8 OPERATING INSTRUCTIONS

- A. Submit for approval a specific set of written operating instructions on each item which requires instructions to operate. After approval, provide one copy for insertion in each Technical Information Brochure.

1.9 MAINTENANCE INSTRUCTIONS

- A. Submit for approval, maintenance information consisting of manufacturer's printed instructions and parts lists for each major item or equipment. After approval, insert information in each Technical Information Brochure.

1.10 GENERAL

- A. Where the requirements of another Division, Section, or part of these specifications exceed the requirements of this Division 26, these requirements shall govern.
- B. In the event this specification varies from the drawings or contract and terms and conditions the other documents shall govern.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 01 00

SECTION 26 05 00 – WORK INCLUDED

PART 1 – GENERAL

1.1 DESCRIPTION OF SYSTEM

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system. The electrical system required under this Division consists of the following:
 - 1. Complete distribution system for lighting including the necessary feeders, branch circuits, lighting fixtures, control switches, dimming systems and receptacles.
 - 2. Complete distribution system for power including feeders, and connections to motors and other power loads.
 - 3. Underground conduits from Utility Company transformer to main switchgear including necessary risers, etc.
 - 4. Cable and conduit per the drawings.
 - 5. A secondary grounding system as indicated and specified.
 - 6. Power and lighting panel boards/load centers.
 - 7. Complete building interior/exterior lighting system.
 - 8. Fire alarm system per NFPA 72.
 - 9. Complete empty raceway system for telephone/CATV.
- B. The following is furnished and installed by others:
 - 1. Conduits and cabling for utility transformer primary items installed under this section.
 - 2. Motors, starters and VFD's.
 - 3. Light fixtures noted as furnished by others. Installation is by this contractor.
 - 4. Pool equipment.
 - 5. Plywood backboards painted on all sides with 2 coats of fire-retardant paint.
 - 6. Concrete work – i.e. transformer pads, housekeeping pads, curbs, bollards, barriers, etc.
 - 7. Disconnects associated with HVAC equipment when integral to the equipment.
 - 8. HVAC controls.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 05 00

SECTION 26 05 01 – ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. Types of electrical identification work specified in this section include the following:
- B. Electrical power conductors.
- C. Electrical Equipment.
- D. Raceways including all conduit and junction boxes.
- E. Operational instructions and warnings.
- F. Danger signs.
- G. Equipment/system identification signs.

1.2 WORK INCLUDED IN OTHER SECTIONS

- A. Section 26 05 33 – Raceways and Conduit
- B. Section 26 05 34 – Outlet Boxes
- C. Section 26 22 00 – Dry Type Transformer
- D. Section 26 23 00 – Distribution Switchboards
- E. Section 26 24 00 – Panel boards and Load centers
- F. Section 26 25 00 – Overcurrent Protective Devices
- G. Section 26 27 00 – Building Wire and Cables
- H. Section 26 28 00 – Enclosed Switches
- I. Section 26 29 00 - Busway
- J. Section 26 30 00 – Motor Starters
- K. Section 26 36 00 – Automatic Transfer Switch
- L. Section 28 00 00 – Fire Alarm and Detection Systems

1.3 REFERENCE STANDARDS

- A. All signs, labels, colors, lettering, styles and sizes of electrical identification shall be in accordance with the applicable requirements of the American National Standards Institute (ANSI).

1.4 SUBMITTALS

- A. Submit a list of equipment requiring a nameplate as specified herein identifying nomenclature and color field.

PART 2 – PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard identification products of categories and types required for each application. Where more than one single identification type is specified for an application, selection is Installer's option. However, identification product shall be consistent for each application.
- B. Color-Coded Plastic Tape
 - 1. Wiring:
 - a. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 3/4" wide for use on non-color coded wires.
 - b. Colors: Conforming to Section 26.27.00, "Wires and Cables."
- C. Circuit and Conduit Identification
 - 1. Mark with an indelible marker the painted covers of all junction boxes to indicate the circuits contained therein.
 - 2. The covers of junction boxes shall be painted as follows:

SYSTEM	COLOR
Communications/Telephone/Data	Yellow
EMCS/Control	Blue
Power (Normal)	Black
Power (Emergency)	Orange
Power (UPS)	Brown
Fire Alarm	Red
Security	Green
 - 3. Locate all openings required for work performed under this section. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.
- D. Self-Adhesive Plastic Signs
 - 1. General: Provide manufacturer's standard, self-adhesive or pressure-sensitive, preprinted, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application.
 - 2. Colors: Unless otherwise indicated or required by governing regulations, provide black signs with white lettering.

- E. Engraved Plastic Laminate Signs
 - 1. General: Provide engraving stock melamine plastic laminate with engraver's standard letter style of sizes and wording indicated, with white lettering in a field to match color coding identified in 2.01, C.2 except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 2. Thickness: 1/16."
 - 3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.2 LETTERING

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown on construction documents, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 – EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. General Installation Requirements
 - 1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of CEC.
 - 2. Coordination: Where identification is to be applied to surfaces, which require finish, install identification after completion of painting.
- B. Danger Signs
 - 1. Locate on doors to all main electrical service entrance rooms, electrical vaults, as indicated in the contract documents. Refer to architectural specifications for additional requirements to be provided by others.
- C. Equipment/System Identification
 - 1. General: Install engraved plastic laminate sign on each major unit of electrical equipment in the building and parking structure; including central or master unit of each electrical system, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in a field to match color coding identified in 2.01 C.2. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work.
 - a. Panel boards, electrical cabinets, and enclosures (individual subcomponents for distribution panel boards)
 - b. Motor starters.
 - c. Transformers.
 - d. Disconnect switches.
 - e. Switchboard (individual sub-components also).
 - f. Automatic transfer switches.

2. Install signs on the equipment at location for best convenience of viewing without interference with operation and maintenance of equipment. For recessed panels in finished areas, provide the sign on the inside of the panel door. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.
3. The Contractors shall coordinate the equipment tag designations and nameplates used to identify each piece of the Division 26 equipment so as to match and correspond to the equipment tag designations indicated on the contract documents. This includes, but is not limited to, the Contractor's shop drawings; submittals; record drawings; wiring diagrams; testing and balancing reports; Operating and Maintenance (O&M) manuals; Energy Management and Control System (EMCS) documents, software, programming, and graphics.

END OF SECTION 26 05 01

SECTION 26 05 15 – TESTING

PART 1 – GENERAL

1.1 WORK INCLUDED IN OTHER SECTIONS

- A. Section 26 05 33 – Raceways and Conduit
- B. Section 26 05 34 – Outlet Boxes
- C. Section 26 22 00 – Dry Type Transformer
- D. Section 26 23 00 – Distribution Switchboards
- E. Section 26 24 00 – Panel boards and Load centers
- F. Section 26 25 00 – Overcurrent Protective Devices
- G. Section 26 27 00 – Building Wire and Cables
- H. Section 26 28 00 – Enclosed Switches
- I. Section 26 29 00 - Busway
- J. Section 26 30 00 – Motor Starters
- K. Section 26 36 00 – Automatic Transfer Switch
- L. Section 28 00 00 – Fire Alarm and Detection Systems

1.2 WORK INCLUDED IN THIS SECTION

- A. Tests shall be conducted by the Contractor as part of the work of this Division and shall include the services of qualified personnel as well as all equipment, apparatus, and services required. Each wiring system with devices connected must test free from short circuits and from grounds and must have an insulation resistance between conductors and ground, based on maximum load, not less than the requirements of the latest edition of the California Electrical Code and National Electrical Code.
- B. Prior to the execution of testing, the Contractor shall notify the Architect of proposed test procedures and forms. The procedures and documentation shall include the items listed herein, applicable code requirements, and manufacturer's recommended installation and acceptance test procedures.
- C. Tests shall include, but not be limited to, the following:
 - 1. Grounding system continuity.
 - 2. Test all operations of all the lighting contactors for the main lobby, exterior light fixtures, etc...

3. Running of mechanical and plumbing equipment with demonstration of controls and interlocks.
 4. Ground fault protection system testing after construction is completed and prior to final acceptance. Certified test results shall be sent to the Engineer from the Contractor. System shall be tested with primary injection method.
 5. Operation of all dry type transformers by recording secondary voltage to assure proper transformer tap settings.
 6. Operation of electrical equipment and appliances whether provided under this Division or not including any portions of electrical power system as required by Architect, Engineer or Owner.
 7. Demonstration and operating test of the fire alarm and detection system including all indicating devices, initiation devices, communication system, on/off controls, door locks, annunciation, fire protection systems, and any other devices or systems. Any tests required by the City, County or State Authorities will be performed. Engineer shall be notified two weeks prior to test for witnessing test.
 8. Operation of standby power system while the system is fully functional to assure proper operation of the emergency generator system, transfer switches, etc.
 - a. Follow NFPA 110 Installation Acceptance Testing.
 - b. Witness test all of the generator system safety, trouble, alarm features.
 - c. Automatic starting through loss of utility power.
 - d. Witness test all automatic transfer switch interfaces and operations.
 - e. Confirm interfaces with EMCS, fire alarm system, remote annunciator, etc.
 - f. Confirm proper functioning of associated equipment (i.e. fuel system, dampers, ventilation, exhaust, etc).
 9. Test the operation and set the lighting schemes for the dimming system(s), if applicable.
 10. Provide the lightning protection grounding system test
 11. Provide busway system installation testing per manufacturer's recommendations. With the busway de-energized and electrically isolated, and all plugs in the OFF position, perform a 1000V megger test on the busway system. Document torquing of joint stack bolts.
- D. All tests must be performed and test results received by Engineer including witnessing of tests prior to final review by Engineer.
- E. Contractor shall submit the required quantity of copies of each complete test report specified herein to the Engineer. Each test report shall include at a minimum all model numbers of test equipment with last calibration date, test personnel, date, time, weather conditions, witnesses, passing requirements, test procedures, test results, equipment settings, etc.
- F. The foregoing shall in no way relieve the Contractor of the warranty requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 05 15

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Testing
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DIVISION 26 – ELECTRICAL

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. Power system grounding.
- B. Communication system grounding.
- C. Electrical equipment and raceway grounding and bonding.

1.2 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment to metallic water service and to supplementary grounding electrodes as indicated per CEC Article 250 and local codes.
- B. Provide communications system grounding conductor at point of service entrance and connect to nearest effectively grounded metallic water pipe or ground rod.
- C. Bond together system neutrals, grounding electrode conductors of separate services, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems per CEC.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

1.3 INSTALLATION

- A. All ground connections buried below grade shall be via the thermos-fusion process unless accessible ground wells are utilized in which case pressure (ground clamps suitable for use in contact with earth) may be utilized

1.4 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAYS & CONDUITS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Description of System
 - 1. Conduit sizes shown on the drawings are to aid the contractor in bidding only; the contractor is responsible for conduit sizes as required by CEC fill tables.
 - 2. In so far as practical this section shall also apply to type MC and AC cable.

1.2 SUBMITTALS

- A. Product Data
 - 1. At the Engineer/owner representative request, product data shall be submitted on conduit and conduit fittings.

PART 2 – PRODUCTS

2.1 LISTING

- A. All raceway shall be listed and labeled.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. All raceways shall be run in neat and workman like manner and shall be properly supported in accordance with latest edition of CEC with approved conduit clamps, hanger rods and structural fasteners. Supporting conduit and boxes with wire is not approved. All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Exposed raceways shall be supported with clamp fasteners with toggle bolt on hollow walls, and with tapcon type fasteners on masonry. Rigid steel box connections shall be made with double Lock nuts and bushings. All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit, not metal conduit. This does not apply to bare copper ground conductors run with feeders (as specified in this section). Conduits shall be run parallel and perpendicular to building walls wherever possible, exposed or concealed, and shall be grouped in a workman like fashion. Crisscrossing of conduits shall be minimized.
- B. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until raceways are complete and construction work which might damage the raceways has been completed.

- C. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- D. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- E. Insulated bushings shall be used on all rigid steel conduits terminating in panels, wire gutters, or cabinets, and shall be impact resistant, plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
- F. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Also, tag conduits in panels where originating.
- G. Raceways which do not have conductors furnished under this Division of the specifications shall be left with an approved nylon pull cord in raceway.
- H. All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12" of flexible steel conduit. Flex connectors shall have insulated throat. Use angle connectors wherever necessary to relieve angle strain on flex conduit. Connections to dry type transformers shall be made with flexible conduit.
- I. Underground cable identification: bury a continuous, pre-printed, bright colored Plastic ribbon cable marker with each underground conduit (or group of conduits), regardless of whether conductors are in conduit. Locate each directly over cables, 6" to 8" below finished grade. Delete this requirement under building slabs and where conduits are concrete encased.
- J. Raceway installed in concrete shall be adequately braced to prevent floating or breaking loose. Raceway in concrete for branch circuits shall be installed in loop, such that if one section is damaged the entire branch circuit can be fed and/or back fed.

END OF SECTION 26 05 33

SECTION 26 08 00 – CODES, FEES, AND STANDARDS

PART 1 – GENERAL

1.1 CODES AND FEES

- A. Install in accordance with the California Electric Code and the regulations of governing local, State, County and other applicable codes, including the Utilities Company.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 08 00

SECTION 26 25 00 – OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. Provide manufacturer's standard, UL listed, molded-case circuit breakers as shown on the drawings and as specified herein.
- B. Provide UL listed fuses as shown on the drawings and as specified herein.
- C. Provide main switchboard overcurrent protective devices.
- D. Provide motor control center branch circuit protective devices.

1.2 REFERENCED STANDARDS

- A. All protective devices shall be designed, manufactured, tested and installed in compliance with the following standards.
 - 1. NFPA 70 - "National Electrical Code" (NEC) and "California Electrical Code" (CEC)
 - 2. UL 489 - "Molded-Case Circuit Breakers and Circuit Breaker Enclosures"
 - 3. UL 977 - "Fused Power Circuit Devices"
 - 4. UL 198D - "High Interrupting-Capacity Class K Fuses"
 - 5. ANSI C97.1 - Low-Voltage Cartridge Fuses.
 - 6. NEMA AB-1 - "Molded-Case Circuit Breakers"
 - 7. UL 943 – GFCI

1.3 SUBMITTALS

- A. Submit manufacturers' literature, illustrations, Engineering data, and specifications for each type and size of device specific to this project. Include a listing of all fuse locations cross referenced with fuse characteristics (type, size, manufacturer, etc.).

PART 2 – PRODUCTS

2.1 MOLDED-CASE CIRCUIT BREAKERS IN PANELBOARDS

- A. The breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break, over-center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual ON and OFF positions. Poles shall be so constructed that they can open, close and trip simultaneously.

- B. Breakers shall be completely enclosed in a molded case with the ampere ratings clearly visible. Contacts shall be non-welding silver alloy. Breakers shall be UL listed for use with 60°, 75° or 90°C insulated wire.
- C. Circuit breaker ratings, modifications, etc., shall be as indicated on the drawings. Molded-case circuit breakers shall be as follows:
 - 1. Thermal magnetic type that provides inverse time-delay overload and Instantaneous short circuit protection by means of a thermal magnetic element.
 - 2. Ambient compensated standard that provides inverse time-delay overload and instantaneous short circuit protection by means of a thermal magnetic element. Compensation shall allow the breaker to carry rated current between 25°C and 50°C with tripping characteristics that are approximately the same throughout this temperature range.
 - 3. Multi-pole breakers shall be of the common trip type having a single operating handle. Multi-pole 240-volt breakers smaller than 70 amperes may consist of factory connected single pole breakers with a common trip handle.
 - 4. All circuit breakers shall be full size and bolt-on.
 - 5. The minimum interrupting rating of 120/208 volt breakers shall be 10,000 amperes RMS symmetrical. The minimum interrupting rating of 277/480 volt breakers shall be 14,000 amperes RMS symmetrical. Refer to manufacturer's short circuit and fault current coordination study for exact interrupting rating.
- D. Molded case circuit breakers indicated for shunt trip shall be UL listed, 60 HZ, factory installed, and have a 120 volt AC coil in addition to the requirements indicated hereinbefore. Trip-coil shall de-energize when breaker opens. Shunt trip breakers shall take an extra pole position within panel boards and may be either left or right mounted. Contractor shall provide the 120 volt circuit to power the shunt trip circuit. The shunt trip circuit activation device shall be a momentary close contact type. Contractor shall coordinate all accessories required for a complete and functional shunt trip circuit.
- E. Circuit breakers supplying mechanical equipment shall be UL listed as HACR type.
- F. Single pole, 120 volt and 277 volt rated branch circuit breakers rated for 15 and 20 amps shall be UL listed for switching duty.

2.2 MAIN SWITCHBOARD OVERCURRENT PROTECTIVE DEVICES

- A. Main and Feeder Overcurrent Devices.
 - 1. Circuit protective device frame sizes 1600 amps and larger shall be 100% rated.
 - 2. Circuit protective device frame sizes 100 amps through 120 amps shall be of the same manufacturer.
 - 3. Circuit protective devices 1000A or larger operating at 480v shall be provided with ground fault protection using a ground fault relay and current transformers as required for tripping under any ground fault condition. The ground fault shall be integral to the trip unit and configured to sense residual. Monitor panel shall be mounted on the front panel with a light to indicate when a ground fault function has occurred. It shall also contain a reset pushbutton, a push to test pushbutton and a control power "on" pilot light.

Ground fault setting shall be set at minimum setting for both current and time during construction. The switchboard manufacturer shall include in the Shop Drawing data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.

- B. Feeder Devices 1200A and Less
- C. Molded case circuit breakers shall be of quick-make, quick-break, trip-free solid state type with frame, trip and voltage ratings as indicated on the drawings. The switchboard shall have space or fully equipped provisions for future units as shown on the drawings.

2.3 FUSES

- A. Fuses shall be listed and meet UL and/or NEMA standards for Class K5, J, R, and L fuses.
- B. Fuses shall be dual-element, high interrupting capacity with current limiting effect, 200,000 ampere RMS symmetrical at rated voltage where possible to coordinate with the series rating of the electrical equipment. Single element devices will only be used where series rating conflicts arise due to UL tested combinations.
- C. Unless otherwise indicated on drawings, Class R or J time-delay fuses shall be used for individual 480 volt motor circuit protection, for motor control centers and motor starter panels protection. Switches shall be provided with proper mounting clips.
- D. Fuse voltage rating shall be 250 volt for 120/208 volt system and 480 or 600 volts for 277/480 volt system.

PART 3 – EXECUTION

3.1 BREAKERS

- A. Install circuit breakers securely in panels as indicated on the contract drawings. Breakers with adjustable magnetic trip shall be set at the highest set-point per the manufacturers recommendation in coordination with the fault current coordination study except where indicated otherwise on the drawings.
- B. Circuit breakers requiring current limiters shall be provided complete with removable current limiters.

3.2 FUSES

- A. Provide fuses in all required devices requiring fuses as required by the drawings, local inspecting authorities, the National Electrical Code and California Electrical Code

3.3 TESTING

- A. The switchboards' protective devices shall be factory tested at the manufacturer's factory prior to shipment as specified herein.

1. The switchboard manufacturer shall provide a ground fault protection system test for circuit testing and verification of the tripping of the ground fault relays at the factory location. The manufacturer shall pass predetermined values of current through the relay sensors and measure the relay tripping time for each phase and the neutral sensor (if one is required). The measured time-current relationships shall be compared to the trip-characteristic curves for each relay. If the relay trips outside the range of values indicated on the curve the relays shall be replaced or recalibrated. This test shall include a polarity verification of the interconnection of the ground sensor circuits.
 2. Additional auxiliary, pilot, control relays, electrically operated breakers, shunt-trip operated breakers, switches etc., shall have the proper voltages applied to their circuits and satisfactory operation demonstrated.
 3. Two (2) copies of all test results certified by the switchboard manufacturer shall be submitted by the Contractor to the Engineer for review.
 4. Upon completion of the factory ground fault protection system tests the current and time adjustments on each relay will be set on their minimum values.
- B. Field testing and set point adjustments shall be performed by manufacturer's technician.
1. The test procedure shall be similar to that specified for the factory test. At a minimum, four values of current shall be primary injected with graphed results. The primary current injection shall confirm that the current transformers, associated wiring, polarity, and trip unit features are installed and operating correctly.
 2. The Contractor shall notify the Engineer in writing at least two weeks prior to the day of the field test. The Engineer may witness the field test if he so desires.
 3. Two (2) copies of all field test results certified by the testing company listed hereinbefore shall be submitted by the Contractor to the Engineer for review. Test results shall include overcurrent device curve, primary injected current values, test results, and other items indicated.

3.4 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY

- A. Contractor shall provide a certified short circuit and protective device coordination study to include all electrical equipment to ensure the UL listing of all new electrical equipment is maintained. This study and the results of this study shall be provided to the contractor and Engineer prior to purchasing and installing any new electrical equipment on this project. All necessary modifications to the new electrical equipment in order to maintain the UL listing of the equipment as a result of this study shall be provided by the contractor and the costs associated with these modifications shall be included in the contractors bid. This study shall include all recommendations regarding calibration, application, duty, setting, and coordination of protective devices. This study shall also include verifying and adjusting all new breaker settings, readjusting breaker settings as required, and any additional relays, controls, wires, conduit, termination blocks, transformers, relay replacements, etc., required for proper coordination. The contractor shall submit tables, charts, time current curves, etc. for the equipment and modifications to the distribution system. Include motor contributions to the system in addition to the fault currents provided by the Utility. Specific attention is brought to automatic transfer switches being UL listed with specific manufacturer's coordinated upstream circuit breakers.

3.5 EQUIPMENT NAMEPLATE DATA

- A. Contractor shall provide overcurrent protection for equipment that does not exceed respective nameplate maximum overcurrent protection (MOP). Contractor shall provide branch circuit wiring for equipment that will be sufficient to meet the respective nameplate minimum circuit ampacity (MCA).

END OF SECTION 26 25 00

SECTION 26 27 00 – BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Conductors
 - 1. Branch circuit and feeder conductors for electric power from panelboards to discrete loads shall be copper or aluminum with type “THHN”, “THWN” or “XHHW” insulation unless specifically noted otherwise. All wire shall be sized shown on the drawings.
 - 2. Feeders and branch circuits less than 100 Amp shall be copper.
 - 3. Type MC or conduit and wire shall be used elsewhere.
- B. Taps and Splices
 - 1. All copper taps and splices in #8 or smaller wire shall be by means of "wirenut" connectors (Ideal or approved equal). All taps and splices in wire larger than #8 shall be made with compression type connectors and taped to provide insulation equal to wire.
 - 2. All taps and splices larger than No. 8 in manholes or in underground pull box shall be made with compression type connectors and covered with Raychem heavy-wall cable sleeves (type CTE or WCS) with type "s" sealant coating or approved equal. Install sleeve kits per manufacturer's installation instructions.
- C. Color Coding
 - 1. All power feeders and branch circuits No. 10 and smaller shall be wired with industry standard color-coded wire. The same color codes shall be throughout the building. Power feeders above No. 10 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall cover at least six inches of the length of conductor insulation within the box or panel.
- D. Submittals
 - 1. At the Engineer representatives request submit manufacturer's data sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs or connectors and cable sleeves.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 27 00

SECTION 26 27 26 – WIRING DEVICES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Wall-switches
- B. Wall-dimmers
- C. Receptacles
- D. Floor-mounted-service-fittings.
- E. Device plates and box covers..

1.2 REFERENCES

- A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- B. FS W-S-896 -Switch, Toggle
- C. NEMA WD 1 - General-Purpose Wiring Devices
- D. NEMA WD 2 - Semiconductor Dimmers for Incandescent Lamps
- E. NEMA WD 5 - Specific-Purpose Wiring Devices

1.3 SUBMITTALS

- A. Submit product data.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WALL SWITCH

- A. Pass and Seymour
- B. Sierra
- C. Hubbell
- D. G.E.

E. Leviton

F. Eagle

2.2 RECEPTACLES

A. Convenience and Straight-blade Receptacles: NEMA WD 1.

B. Locking-blade Receptacles: NEMA WD 5.

C. Convenience Receptacle Configuration: NEMA WD 1; Type 5.

D. Specific-use Receptacle Configuration: NEMA WD 1 or WD 5; type as indicated on Drawings.

E. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter.

F. Color: White

2.3 ACCEPTABLE MANUFACTURERS - WALL DIMMERS

A. Vantage

2.4 WALL DIMERS

A. Wall Dimmers: NEMA WD 2; linear slide type.

B. Rating: 600 Watts minimum, larger size to accommodate load shown on drawings.

C. Color: White

2.5 WALL PLATES

A. Decorative Cover Plates: Smooth plastic.

B. Weatherproof Cover Plate: gasketed stainless steel with hinged gasketed device hood.

C. Color: White

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install all devices to centerline as indicated on the drawings. Unless noted otherwise, OFF position down for switches.

B. Install wall dimmers as indicated on the drawings. De-rate ganged dimmers as instructed by manufacturer; do not use common neutral, use separate box to avoid de-rating.

C. Install convenience receptacles as indicated on the drawings, grounding pole on bottom or right side for horizontal mounting applications.

- D. Install specific-use receptacles at heights shown on drawings.
- E. Install cover plates on switches, receptacles, and blank outlets in finished areas.
- F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- G. Install devices and wall plates flush and level.

END OF SECTION 26 27 26

SECTION 26 28 00 – ENCLOSED SWITCHES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Safety Switches.

1.2 SUBMITTALS

- A. Submit product data on all major types of disconnects..

PART 2 – PRODUCTS

- A. All disconnect switches shall be general duty 120/208v, or heavy duty type 277/480v, unless specifically noted otherwise.
- B. Switches shall have fusible, non-fusible, size, and enclosure as indicated on the drawings.
- C. Switches shall be 240 volt rated on systems up to and including 240V and 600V rated on higher voltage systems.
- D. NEMA 1 enclosures, unless otherwise noted. All switches mounted outdoors shall be NEMA Type 3R unless otherwise noted.
- E. All switches for motors shall be dual horsepower rated.
- F. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.

PART 3 – EXECUTION

1.3 INSTALLATION

- A. Install switches and enclosures plumb; anchor securely to wall or structural supports at each corner, minimum.
- B. Install trim plumb.
- C. Coordinate location of switch with equipment being served to allow easy access to switch once equipment is installed.

END OF SECTION 26 28 00

SECTION 26 30 01 – CONTROL WIRING

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. Provide the motor starters as shown on the contract documents and as specified herein.

1.2 WORK INCLUDED IN OTHER SECTIONS

- A. Section 26 05 01 – Electrical Identification
- B. Section 26 05 15 – Testing

1.3 REFERENCE STANDARDS

- A. All busways shall be designed, manufactured, tested and installed in compliance with the following standards:
 - 1. California Electrical Code and NFPA 70 National Electrical Code
 - 2. NEMA IC Standards
 - 3. IEC 947
 - 4. UL 508

1.4 ACCEPTABLE MANUFACTURERS

- A. If it complies with these Specifications, equipment manufactured by one of the following Manufacturers will be acceptable: General Electric, Siemens, Cutler-Hammer, Square D

1.5 SUBMITTALS

- A. Submit manufacturer's literature, illustrations, engineering data and specifications for each type and size of motor starter specific to this project. A comprehensive list of equipment with each piece of equipment identified by contract document designation shall be submitted with cross reference to type of motor starter being supplied for it. Submit schematic wiring diagrams indicating all accessories for each type of motor starter specific to this project. All accessories shall be integrated within overall wiring diagram and the automatic temperature control and fire alarm interface point(s) shall be indicated. Catalog numbers shall contain suffix and/or prefix numbers/letters representing accessory modifications. Suffix and/or prefix numbering definitions shall be included in submittal.

PART 2 – PRODUCTS

2.1 TESTING

- A. All controls, interlocks, safety devices and alarms shall be tested by contractor after final installation prior to final review by Engineer.

2.2 MATERIALS

- A. All control wiring shall be copper conductor as specified installed in conduit.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 30 01

SECTION 26 50 00 – LIGHTING FIXTURES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Description of System
 - 1. Light fixtures furnished under this Section shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the drawings.
 - 2. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures..

1.2 SUBMITTALS

- B. Product Data
 - 1. Product data shall be submitted for all light fixtures showing:
 - a. Dimensions
 - b. UL Label
 - c. Lens/louver thickness
 - d. Finish
 - e. Voltage
 - f. Lamps
 - 2. Product data shall be submitted showing manufacturer's written recommendations for storage, handling, and installation instructions.

1.3 PRODUCT STORAGE AND HANDLING

- C. Physically protect fixtures against damage as recommended by manufacturer.

PART 2 – PRODUCTS

1.4 ACCEPTABLE MANUFACTURERS

- D. Manufacturers: Provide fixtures as shown on the fixture schedule or as approved by owner.

1.5 EQUIPMENT

- E. HID fixture ballasts for all non-dimmed fixtures shall be high power factor type. Voltages shall comply with system to which applied.
- F. All fluorescent ballasts shall be electronic, instant-on.
- G. All ballasts furnished under this Section shall be high power factor type. Ballasts shall be rated for voltage system to which applied.
- H. All lamps shall be as indicated on the fixture schedule. Incandescent lamps shall be rated and stamped for 130 volts.

- I. Fixtures that require emergency battery backup shall be equipped with the appropriate ballasts.

PART 3 – EXECUTION

1.6 INSTALLATION

- J. Install all fixtures in accordance with manufacturer's written instructions and CEC.
- K. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.

1.7 CLEAN-UP

- L. Luminaries
 - 1. At the time of installation, clean free from dust and dirt. Lenses, which are kept in original containers until immediately prior to final inspection, may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges. Any reflectors that have fingerprints or smudges that cannot be removed shall be replaced at no cost to the owner.

END OF SECTION 26 50 00

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Removal of existing trees and vegetation
- B. Clearing vegetation, debris, trash and other materials within limits indicated
- C. Grubbing of vegetation within limits indicated
- D. Stripping of topsoil within limits indicated
- E. Removing above-grade site improvements within limits indicated
- F. Disconnecting, capping or sealing, and abandoning site utilities in place
- G. Disconnecting, capping or sealing, and removing site utilities
- H. Disposing of objectionable material

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 12 16, Asphalt Paving
- C. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Investigation and Percolation Report City of El Segundo Recreation Park Renovation Project – Phase 1 by Converse Consultants, dated November 12, 2024.
- B. ANSI A300: Industry Standards for Tree Care Practices
- C. Applicable Publications
 - 1. “Trees and Building Sites,” official publication of the International Society of Arboriculture.
 - 2. “Arboriculture,” the care of trees and shrubs by Dr. Richard Harris.

1.4 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. CAL-OSHA: California Occupational Safety and Health Administration

- C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

- A. Do not remove or prune trees without first securing a permit from the appropriate agency.
- B. Prune to the standards of the International Society of Arborists and to ANSI A300.

1.7 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the City's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the City's Representative. Avoid damaging materials designated for salvage.
- C. Unidentified Materials;
 - 1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the City's Representative.
 - 2. If necessary, the City's Representative will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to engineered fill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain during construction.

3.2 TREE REMOVAL

- A. Remove trees designated for removal prior to the construction of new improvements in the vicinity:
 - 1. When demolishing trees indicated to be removed within areas for new pavement or hardscape, remove tree, stump to a depth of two (2) feet below finish grade, and all roots located in the top twelve (12) inches of soil. Remove wood chips created from grinding process down to remaining stump then refill void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Import soil and compaction in future paved areas shall be in accordance with Section 32 12 16, Asphalt Paving and Section 32 13 13, Concrete Pavement.
 - 2. When demolishing trees indicated to be removed within new landscaped areas, removal shall be done in one of the following ways:
 - a. For trees located in accessible areas, remove tree and grind stump to four (4) inches below finish grade. Backfill the void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Do not remove existing roots.
 - b. For trees located in inaccessible areas, cut stump flush with finish grade, and cover with 3 inches of bark mulch. Do not grind the stump and do not remove existing roots.
- B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA tree work protection standards and ANSI A300 Standards.
- C. All trees to be demolished shall be removed in such a way as to not damage branches, trunks, or root systems of adjacent trees.

3.3 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to the City's Representative.
- B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the City's Representative.
 - 1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.

2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the City's Representative.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by City's Representative or others unless authorized in writing by the City's representative, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the City's Representative and utility company affected. Notify City's Representative and utility company affected two working days prior to utility interruptions.
- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Fill abandoned piping with cement slurry.
- H. Securely close ends of abandoned piping with tight fitting plug or cement slurry minimum 6 inches thick.

3.5 CLEARING AND GRUBBING

- A. Areas to be graded shall be cleared of existing vegetation, rubbish, existing structures, and debris.
- B. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Use only hand methods for grubbing within drip line of remaining trees.

3.6 SITE STRIPPING

- A. Strippings and spoils shall be disposed at an off-site location, per geotechnical recommendations.
- B. Remove vegetation before stripping soil.

- C. Surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be relatively shallow (i.e. less than 2 inches); deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots.
- D. Remove trash, debris, weeds, roots, and other waste materials.
- E. Stockpile soil materials designated to remain on site at a location approved by the City's Representative at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- F. Do not stockpile soil within drip line of remaining trees.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in accordance with Section 31 20 00, Earth Moving.

3.9 DISPOSAL

- A. Remove surplus soil material, unsuitable soil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the City's property.

END OF SECTION

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SECTION 31 20 00 – EARTH MOVING FOR SKATEPARKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Perform all earthwork for skatepark items as indicated on the construction drawings and specified in the contract documents.

1.2 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to perform all earthwork operations related to the skatepark as indicated on the construction drawings. Complete as shown and as specified herein.

1.3 QUALITY ASSURANCE

- A. Testing services: coordinate the following testing with the owner retained testing agency (if required by the project standard specifications):
 - A. Material evaluations tests for aggregate base, subgrade, and imported structural fill.
 - B. Inspection of structural fill placement and compaction.
 - C. Inspection of final subgrade.
 - D. Base material compaction test for every 1000 s.F. Of concrete flatwork in skatepark area to ensure 90% compaction in accordance with civil engineering specifications and testing agency recommendations.
- B. The earthwork shall be done under supervision of a soils engineer retained by the owner (if required by the project), who shall verify earthwork specifications for the support of slab on grade and for the control of soil swelling. Field density tests to determine the level of compaction being achieved in the fill shall be performed on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.
- C. A soils report may not exist for this project. Owner shall retain a soils engineer (if required by the project) to verify excavations for assumed allowable soil bearing, low settlement and swell potential, and to make any additional recommendations.

1.4 PROJECT CONDITIONS

- A. Existing conditions: the existing topographic conditions are shown on the drawings for reference only.
- B. Upon beginning the earthwork, contractor represents that he has inspected the site and satisfied himself as to actual grades and levels and the true conditions under which the work is to be performed.
- C. Promptly notify the owner's representative of unexpected subsurface conditions.

1.5 PROTECTION

- A. Maintain benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
- B. Protect excavations by shoring, bracing, sheeting, underpinning, or other methods, as required to prevent cave-ins or loose dirt from entering excavations. Barricade open excavations adjacent to public streets and walks.
- C. Cover holes and trenches when work is not in progress.
- D. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repair at contractor's expense.

1.6 REFERENCE STANDARDS

- A. ASTM – american society for testing and materials.
- B. Standard specifications (as specified in the general provisions)

PART 2 – PRODUCTS

- A. Provide structural fill as required to meet proposed subgrade elevations in accordance with grading plan, civil engineering specifications and testing agency recommendations.
- B. Provide the specified depth of compacted aggregate base material if required.
- C. Suitable materials may be obtained from onsite excavations, may be processed onsite materials, or may be imported provided these materials meet all the requirements in the contract documents. If imported materials are required to meet the requirements of this section or to meet the quantity requirements of the project, the contractor shall provide the imported fill materials and the required conformance reports of test results at no additional expense to the owner, unless a unit price item is included for imported materials (including the appropriate required testing reports) in the bidding schedule.

PART 3 - EXECUTION

- A. Establish and maintain required lines and grade elevations. Designate and identify datum elevation and project engineering reference points.
- B. Before starting grading and excavation, establish the location and extent of underground utilities in the work area. Exercise care to protect existing utilities during earthwork operations. Perform excavation work near utilities by hand and provide necessary shoring, sheeting, and supports as the work progresses. Notify respective utility companies of damage caused to active utilities immediately.
- C. Proof-roll exposed subgrades with a loaded tri-axle dump truck or a similar sized piece of rubber-tired construction equipment to assist in the evaluation of the subgrades across the site. If unstable areas are detected, an initial attempt should be made to aerate (12 inches min.) and densify the subgrade by recompaction where natural moisture contents are at appropriate

levels. If this procedure is ineffective, the disturbed soils should be undercut and replaced with clean fill and/or stabilizing materials. Compact to 90% of the maximum dry density in accordance with astm d698 standard proctor method. Fill and consolidate depressed areas. A firm, non-yielding subgrade should be established prior to proceeding with fill placement.

- D. Soil compaction shall be achieved by means of pneumatic tire rollers, hoe packs, ride-on drum roller or other mechanical tampers (plate, rammer, or walk behind roller).
- E. Bring up fill using stockpiled material and/or approved material with low plasticity. The fill should be placed in lifts thin enough to attain the specified compaction level throughout the entire lift thickness. Prior to compaction, moisture condition as needed. Compact each lift to at least 90 percent of astm d698.
- F. The excavation contractor shall remove all swellable soil as directed by the soils engineer.
- G. Excavation and compaction of fill shall extend to 5 feet beyond skate park footprint.
- H. Any portion of the backfill operation that does not meet the minimum compaction requirements of this section shall be removed, recompacted, and re-tested at the cost of the contractor until passing tests are obtained.
- I. Proceed with sub-base if required only after nonconforming conditions have been corrected and subgrade has been inspected. A firm, non-yielding subgrade should be established prior to base course placement.
- J. Provide the specified depth of compacted aggregate base material if required. Compact aggregate base to 90% of the maximum dry density in accordance with astm d698 standard proctor method if required.
- K. Proceed with concrete only after nonconforming conditions have been corrected, subgrade has been inspected, and formwork and field mock-ups have been reviewed.
- L. Upon completion of earthwork operation, clean areas within contract limits, remove tools and equipment.
- M. Remove and dispose of properly off site all rocks and other debris from grading operations at approved recycling centers and/or licensed landfill, in accordance with local codes and ordinances.

END OF SECTION 31 20 00

SECTION 31 21 00 - UTILITY TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping, underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc., and associated structures.
- B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
 - 1. Select Backfill Material
 - 2. Aggregate Base
 - 3. Detectable Tape
 - 4. Trench Excavation
 - 5. Pipe Bedding
 - 6. Trench Backfill
 - 7. Trench Surfacing

1.2 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earthwork Moving
- C. Section 33 41 00 – Storm Utility Drainage Piping

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Investigation and Percolation Report City of El Segundo Recreation Park Renovation Project – Phase 1 by Converse Consultants, dated November 12, 2024.
- B. ASTM
 - 1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 2. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.
- C. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.
- D. Caltrans Standard Specifications, 2015
 - 1. Section 19, Earthwork
 - 2. Section 26, Aggregate Bases
 - 3. Section 68, Subsurface Drains
 - 4. Section 96, Geosynthetics

E. CAL/OSHA, Title 8

1.4 DEFINITIONS

A. AC: Asphalt Concrete

B. ASTM: American Society for Testing and Materials

C. Base: The layer placed between the subgrade and surface pavement in a paving system.

D. Bedding: Material from bottom of trench to bottom of pipe

E. CDF: Controlled Density Fill

F. DIP: Ductile Iron Pipe

G. Engineered Fill:

1. Soil or soil-rock material approved by the City and transported to the site by the Contractor in order to raise grades or to backfill excavations.
2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.

H. Excavation: Consists of the removal of material encountered to subgrade elevations

I. Initial Backfill: Material from bottom of pipe to 12 inches above top of pipe

J. PCC: Portland Cement Concrete

K. RCP: Reinforced Concrete Pipe

L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

M. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

O. Subsequent Backfill: Material from 12 inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

P. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.

1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Engineer.

2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.

Q. Utility Structures:

1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
2. Sanitary sewer manholes, vaults, etc.
3. Water vaults, etc.

1.5 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 10 00 – Supplemental General Requirements.
- B. Test Reports: Submit the following report for import material directly to the City from the Contractor's testing services:
 1. Compaction test reports for aggregate base.
- C. Samples:
 1. If required by the Geotechnical Engineer, provide 20-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Engineer and the City.
 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer and the City.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19, Earthwork.
- C. The Geotechnical Engineer will perform observations and tests required to enable them to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- D. Soil Testing:
 1. Contractor to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
 2. Test results will be submitted to the City.

1.7 PROJECT CONDITIONS

- A. Promptly notify the City of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the City verbally to permit

verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the City in writing of differing conditions prior to contractor starting work on affected items.

- B. Barricade open excavations and post with warning lights.
 - 1. Operate warning lights and barricades as required.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
 - 3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.
- D. Provide dust and noise control in conformance with Section 01 10 00 Supplemental General Requirements.
- E. Environmental Requirements:
 - 1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
 - 2. Protect existing streams, ditches and storm drain inlets during work on this project.
- F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- G. Transport all excess soils materials by legally approved methods to disposal areas.
 - 1. Coordinate with the Engineer.
 - 2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
 - 1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult City and/or utility agency immediately for directions.
 - 1. Cooperate with the City and public and private utility companies in keeping their respective services and facilities in operation.
 - 2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.
- C. Do not interrupt existing utilities serving facilities occupied and used by the City or others, except when permitted in writing by the City and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Import materials will be subject to approval of the Geotechnical Engineer.
- B. For approval of imported fill material, notify the City at least 7 days in advance of intention to import material.

2.2 PIPE BEDDING AND INITIAL BACKFILL

- A. ASTM D2321, Class IA, IB or II.
 - 1. Clean and free of clay, silt or organic matter.
- B. Permeable Material: In accordance with Section 68-2.02F of Caltrans Standard Specifications, Class 1, Type A or Class 2.
- C. Class 2 Aggregate Base: In accordance with Section 26 of Caltrans Standard Specifications, $\frac{3}{4}$ inch maximum.
- D. Sand: In accordance with Section 19-3.02F of Caltrans Standard Specifications.

2.3 SELECT BACKFILL

- A. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
$\frac{3}{4}$ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

- B. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

Sieve Size	Percentage Passing
No. 4	100
No. 200	0 -5

2.4 WARNING TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

1. Warning Tape Color Codes
 - a. Red: Electric
 - b. Yellow: Gas, Oil; Dangerous Materials
 - c. Orange: Telephone and Other Communications
 - d. Blue: Water Systems
 - e. Green: Sewer Systems
 - f. White: Steam Systems
 - g. Gray: Compressed Air
2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 20 00, Earth Moving.

2.6 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8 inch top size. The 3/8 inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C260.
- E. Aggregates need not meet the standards as set forth in ASTM C33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.
- H. Mix design shall meet the Geotechnical Engineer's approval.

2.7 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Engineer.
- B. Poured-in-Place Structures:
 - 1. Bedding: Bedding shall meet the approval of the Geotechnical Engineer. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 20 00, Earth Moving.

2.8 GEOSYNTHETICS

- A. Filter Fabric:
 - 1. Filter Fabric: Section 96-1.02 of Caltrans Standard Specifications.
 - 2. Mirafi 140N, Mirafi Inc., or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the recommendations of the Geotechnical Engineer.
- B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.
- C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.
- D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.
- E. Prior to commencement of work, become thoroughly familiar with site conditions.
- F. In the event discrepancies are found, immediately notify the City in writing, indicating the nature and extent of differing conditions.
- G. Backfill excavations as promptly as work permits.

- H. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the City.
- I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- J. In excavations, use satisfactory excavated or borrow material.
- K. Under grassed areas, use satisfactory excavated or borrow material.

3.2 SITE PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the City.

3.3 EXISTING UTILITIES

- A. Identify the location of existing utilities.
 - 1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
 - 2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
 - 3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the City to clear the utility.
- B. Protect all existing utilities to remain in operation.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
 - 1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
 - 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 - 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 - 4. Report damage of utility line or subsurface structures immediately to the City.

- E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.4 TRENCH EXCAVATION

A. General

1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:

1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or at right angles to the alignment of the sidewalk.
3. Boards or other suitable material shall be placed under equipment outriggering to prevent damage to paved surfaces.

C. Trench Width:

1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
 - a. The maximum trench width shall be inclusive of all shoring.
 - b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Excavation Width at Springline of Pipe:

1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Engineer.
2. Nominal pipe diameter of 30 inches through 36 inches: Minimum of the outside pipe diameter plus 2 feet, or as otherwise allowed or required by the Geotechnical Engineer.
3. Nominal pipe diameter of 42 inches through 60 inches: Minimum of the outside pipe diameter plus 3 feet, or as otherwise allowed or required by the Geotechnical Engineer.

- E. Open Trench:
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
 2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
 3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
 4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
 5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
 6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
 7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.
- F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
 2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
 3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.5 CONTROL OF WATER AND DEWATERING

- A. Contractor attention is directed to Section 31 23 19, Dewatering.
- B. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Engineer and the City until backfilling is completed.
- C. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- F. Maintain dewatering system in place until dewatering is no longer required.

3.6 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the City, submit details and calculations to the City. The City may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the City.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.7 PIPE BEDDING

- A. Obtain approval of bedding material from the Geotechnical Engineer.
- B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.
- C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.
- D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.8 BACKFILLING

- A. Initial Backfill:
1. Obtain approval of backfill material from Geotechnical Engineer.
 2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of initial backfill material will not be permitted.
- B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.
- C. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous lap tape ends a minimum of 2 feet.
- D. Subsequent Backfill:
1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
 2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of subsequent backfill material will not be permitted.
- E. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.
- F. Utility backfill shall be inspected and tested by the Geotechnical Engineer during placement. Cooperate with the Geotechnical Engineer and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Engineer and the City prior to proceeding with the Project.

- G. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.9 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the City.

END OF SECTION

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SECTION 31 23 00 – EXPANDED POLYSTYRENE GEOFOAM

EPS GEOFOAM

- A. Section includes expanded polystyrene (EPS15) geofoam.
- B. References: astm d6817 - standard specification for rigid, cellular polystyrene geofoam.
- C. Submittals: submit eps geofoam (type EPS15) manufacturer's product literature and techdata, including:
 - A. Physical properties in compliance with ASTM d6817 type specified.
 - B. 10-year physical property warranty.
 - C. Shop drawings showing eps geofoam block layout.
- D. Deliver eps geofoam labeled with material type. Store above ground, and protected from moisture and sunlight prior to installation. Product should not be exposed to open flame or other ignition sources.
- E. Warranty: provide eps15 geofoam 10-year warranty covering the long-term physical property of expanded polystyrene geofoam.
- F. Manufacturers/suppliers:
 - A. Iowa eps products, inc., 5554 n.E. 16th st., des moines, ia 50313, 515.262.0882
 - B. Thermal foams/syracuse, inc. 6173 s. Bay rd., cicero, ny 13039, 315.699.8734
 - C. Insulfoam, manufacturing, 4500 s. Frontage rd., lakeland, fl 33815, 800.242.8879
 - D. Universal foam products, 16 stenersen ln., ste. 4b, hunt valley, md 21030, 410.825.8300
- G. All eps geofoam blocks shall be treated by the manufacturer with a tested and proven termite treatment for below grade applications, 3 year minimum field exposure. The treatment shall be EPA registered, meet requirements of icc es ac239, and be recognized in an icc es report.
- H. Comply with manufacturer's eps geofoam product data; including technical bulletins.
- I. Verify conditions of substrate, grade and other conditions which affect installation of geofoam.
- J. Install geofoam eps blocks with minimal spacing between blocks. Secure into Position with construction adhesive and reinforcing steel dowel "staples" to ensure there is no lateral movement at the time of concrete placement.
- K. Protect installed product and finish surfaces from damage during construction as required.

END OF SECTION 31 23 00

SECTION 32 05 23 – CONCRETE ATHLETIC COURT COATINGS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. StreetBond® Advanced Coatings are specifically formulated for application to asphalt pavement but also excel over concrete when a primer is used. StreetBond® have been confirmed by a certified testing facility to possess a balance of performance properties for a durable and color-fast finish.
- B. A variety of StreetBond® coating colors are available. Please refer to streetbond.com to view these. Custom colors are available upon request.
- C. Certain colors of the StreetBond® coatings have had SR values independently verified and can help projects qualify for points in the LEED® program under Heat Island Effect: Non-Roof. Please refer to streetbond.com for further information.
- D. Primer specified for use with StreetBond® coatings shall be StreetBond® WB Concrete Primer, StreetBond® QS Concrete Primer or approved alternative.
- E. Qualifications. Only Certified StreetBond® Applicators may bid for and perform the imprinted portion of this work. Please refer to Section 1.3 DEFINITIONS.
- F. StreetBond® products are manufactured in ISO 9001:2008 / ISO 14001:2004 facilities to ensure quality products produced in legally-responsible and environmentally-conscious manner.
- G. StreetBond® coatings are only available from GAF.

1.2 REFERENCES

A. ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tester.
B. ASTM D4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
C. ASTM D2697	Standard Test Method for Volume of Nonvolatile Matter in Clear or Pigmented Coatings.
D. ASTM D522-93A	Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.
E. ASTM D1653	Standard Test Method for water vapor transmission through organic film coatings.
F. ASTM G154 QUV	Accelerated Weathering Environment. Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
G. ASTM D2369	Weight Solids Standard test method for Volatile Content of Coatings.

H. ASTM D1475	Standard Test method for Density of Paint, Varnish, Lacquer, Other related products.
I. ASTM D2240 (2000)	Standard Test Method for Rubber property – Durometer hardness.
J. ASTM D5895	Standard Test Method of drying or curing during film formation of organic coatings using mechanical recorders.
K. ASTM D570	Standard Test Method for water absorption of plastics.

1.3 DEFINITIONS

- A. “Certified StreetBond® Applicator” has valid Certification for SB120/150 as offered by GAF - StreetBond and reviewed on a bi-annual basis. All Certified StreetBond® Applicators with appropriate Certification have been qualified by StreetBond to perform the Work and offer a product Warranty.
- B. “Approved Applicator” has valid Certification for SB120/150 as offered by GAF - StreetBond and are reviewed on a bi-annual basis. Product Warranties may be available to Approved Applicators but require approval and supervision by a GAF - StreetBond Technical Sales Representative.
- C. “Applicator” means the installer of the StreetBond® coatings.
- D. “Owner” means the Owner and refers to the representative person who has decision making authority for the Work.
- E. “TSR” is a GAF - StreetBond Technical Sales Representative who manages the StreetBond® product in a given territory.
- F. “Concrete pavement” is concrete pavement to which coating will be applied and once the surface has been properly repaired.
- G. The “Work” is the concrete pavement coating work contemplated in this bid submission and specification.
- H. “Layer” is a signal thin pass of coating, applied with a texture spray gun, which is allowed to dry before the next layer is applied.
- I. “Warranty” is a guarantee to the property owner that StreetBond® SB150, when properly applied, will not peel, delaminate or show abnormal wear over specific period of time depending on the traffic volumes and number of layers applied. Please contact your local TSR for more details.

1.4 SUBMITTALS

A copy of the Accreditation Certificate, available from the Applicator, is required with submittal. Independent product test results available upon request.

- A. Provide a shop drawing with color and striping layout for approval prior to installation.

PART 2 – PRODUCTS

2.1 MATERIALS – STREETBOND® COATINGS

StreetBond® coatings have been scientifically formulated to provide the optimal balance of performance properties for a durable, long-lasting color and textured finish to any pavement surfaces. Some of these key properties include wear and crack resistance, color retention, adhesion, minimal water absorption and increased friction properties. StreetBond® coatings are environmentally safe and meet EPA requirements for Volatile Organic Compounds (VOC).

- A. StreetBond® SB150 is a two-part premium epoxy-modified, acrylic, waterborne coating specifically designed for application on asphalt pavements but also excel over concrete when a primer is used. It has a balance of properties to ensure good adhesion and movement on flexible pavement, while providing good durability. StreetBond® SB150 is durable in both dry and wet environments.
- B. StreetBond® Colorant is a highly concentrated, high quality, UV stable pigment blend designed to add color to StreetBond® SB150 coatings. One unit of Colorant shall be used with one pail of StreetBond® coating material.
- C. StreetBond® QS Concrete Primer is a clear, two component epoxy polyamide primer specifically designed to increase the bond for StreetBond® coatings to concrete surfaces. StreetBond® WB Concrete Primer is a clear, single component epoxy primer specifically designed to increase the bond for StreetBond® coatings to concrete surfaces. Both primers protect against destructive salts, oils, solvents and gasoline. Their low viscosity allows penetration into the surface creating a tenacious physical and chemical bond.

2.2 PROPERTIES OF STREETBOND® COATINGS

The following tables outline the test results for physical and performance properties of the StreetBond® coatings as determined by an independent testing laboratory.

TABLE 1: Physical Properties of StreetBond® SB150 Coatings

Characteristic	Test Specification	SB150 range
Solids by Volume	ASTM D2697	53.5% - 60.5%
Solids by Weight	ASTM D2369	70% - 76%

TABLE 2: Typical Performance Properties of StreetBond® SB150 Coatings

Characteristic	Test Specification	SB150 range
Dry time (To re-coat)	ASTM D5895 @23°C; 37% RH	30 - 45 min
Taber Wear Abrasion Dry H-10 wheel	ASTM D4060 7 day cure	0.16 - 1.0 g/1000 cycles

Taber Wear Abrasion Wet H-10 wheel	ASTM D4060 modified 7 day cure	1.5 - 4.0 g/1000 cycles
Hydrophobicity Water Absorption (670 hr, 23C)	ASTM D471	8% - 12%
Mandrel Bend	ASTM D522 - 93A	0.5" to 1.00"
VOC	per SDS	<50 g/liter
Adhesion	ASTM D4541	300 – 1400 psi (or cohesive asphalt failure before adhesion failure)
Friction Wet & Dry	ASTM E303 British Pendulum Tester	Dry 55-90 Wet 35-75 Note: Friction is affected by the texture of the substrate.
MEK scrubs 5,000 cycles	ASTM D2486 (modified)	0% exposed substrate

Certificates of Analysis are available upon request for each of these properties.

2.3 EQUIPMENT FOR STREETBOND® APPLICATION

The equipment described has been designed specifically for optimal application of StreetBond® coatings. Other equipment may or may not be suitable and could compromise the performance of the StreetBond® coatings and/or reduce crew productivity.

- A. The SB Flex Sprayer is a proprietary coating sprayer supplied by Intech Equipment and is capable of applying the StreetBond® coatings to the asphalt pavement surface in a thin, controlled film which will optimize the drying and curing time of the coating. A Graco RTX and RapidSprayer II sprayer may also be used.
- B. The StreetBond® Coatings Mixer is a motorized mixing device designed to ensure efficient and thorough blending of the StreetBond® components.
- C. Backpack or Handheld sprayer to apply the diluted StreetBond® Adhesion Promoter Concentrate.
- D. The RapidFinisher II is an electric powered broom produced by HUB Surfaces Systems which can be used in the application of StreetBond® coatings to improve productivity. It is especially useful on larger projects.

2.4 COLOR

- A. Refer to Multi Purpose Court Paving Enlargement for color and striping layout.

- B. Colors
 - 1. “CL Shamrock Green”
 - 2. “SR White”
 - 3. Custom color “PMS 637”
 - 4. Custom color “PMS 640C”
 - 5. Custom color “PMS 7457”
- C. Provide a shop drawing with color and striping layout for approval by Landscape Architect prior to installation.

PART 3 – EXECUTION

3.1 GENERAL

StreetBond® coating shall be supplied and applied on concrete surface by a Certified StreetBond® Applicator in accordance with the plans and specifications or as directed by the Owner. Do not begin installation without confirmation of an Accreditation Certificate. Specifications for the execution of the StreetPrint® system can be found at streetbond.com.

3.2 PRE-CONDITIONS

The condition of the concrete substrate will impact the performance of the StreetBond® coatings. A highly stable concrete pavement free of defects is recommended.

3.3 CONCRETE SURFACE PREPARATION

- A. Concrete should be wet cured (no curing compound).
- B. 28 days after placement of concrete, shotblast with steel shot to International Concrete Repair Institute CSP 4 (assessed using ICRI rubber comparators). The steel shot should be S-280 (0.028 in. (0.71 mm) or S-330, 0.033 in. (0.84 mm).
- C. Conduct a moisture test to ensure moisture levels in the slab are acceptable. The preferred test is ASTM F2170 relative humidity test. A relative humidity level of 75% is desired. Using a moisture meter to measure levels deeper in the slab is an alternative test with a target of 7%. ASTM D-4263 “plastic sheet method” is commonly used. The preference is that there is no moisture present under the sheet, either in the form of droplets on the underside of the plastic sheet or a darkening of the concrete surface. StreetBond is breathable and will tolerate a small amount of moisture so some judgment can be applied.
- D. Apply StreetBond Primer QS per application instructions, mixed 1 part Part A, one part Part B and diluted with 2 parts Acetone, MEK or Xylol by volume. Coverage rate should be 0.4 to 0.5 diluted gallons/100 ft².
- E. Allow QS Concrete Primer to fully dry before applying StreetBond coatings. Surface may be slightly tacky, but must not transfer residue to hands or feet. Primer must be coated with StreetBond coating within 48 hours for optimum bonding results.

3.4 COATING APPLICATION GUIDELINES

- A. The Applicator shall use the SB Flex Spray System or suitable texture coatings sprayers to apply the StreetBond® coatings.
- B. The concrete pavement surface shall be completely dry and thoroughly cleaned prior to application of the coatings.
- C. StreetBond® QS Concrete Primer, StreetBond® WB Concrete Primer or approved alternative shall be applied and allowed to cure prior to the first layers of coating. Please consult Technical Data sheets for more details on applications and mixing instructions.
- D. The first layer of coating shall be spray applied then broomed to work the coating material into the pavement surface. Subsequent applications shall be sprayed then broomed or rolled. Each application of coating material shall be allowed to dry to the touch before applying the next layer.
- E. The Applicator shall apply the StreetBond® coatings only when the air temperature is 50°F / (10°C) and rising and will not drop below 50°F / (10°C) within 24 hours. No precipitation should be expected within 24 hours.

3.5 COATING COVERAGE & THICKNESS

Coating coverage and thickness is as outlined in TABLE 4 below. Actual coverage may be affected by the texture of the concrete pavement. There will be less coverage with the first layer and higher coverage with subsequent layers.

TABLE 4: Coating Coverage & Thickness

# OF LAYERS	COVERAGE (approx.)		THICKNESS (approx.)			
	NON-TEXTURED		WET		DRY	
	sqft/unit*	sqm/unit*	mm	mil	mm	mil
3	200	18.6	0.84	33	0.48	19
4	150	13.9	1.12	44	0.66	26
5	120	11.2	1.40	55	0.81	32
6	100	9.3	1.68	66	0.97	38

**1 unit is a nominal 5 gallon pail comprising Part A, Part B and Colorant (approximately 4.12 gallons). 1 unit when sprayed as a single layer covers approximately 600sqft (55.7 sqm), with an approximate thickness of 6.3mil (0.16mm) dry. Smoother concrete surfaces will increase your coverage rate per unit.*

3.6 RECOMMENDED COATING COVERAGE RATES

Please check with GAF - StreetBond in advance to confirm the recommended application for the climate conditions at the project location.

TABLE 5: Recommended Coating Coverage Rates

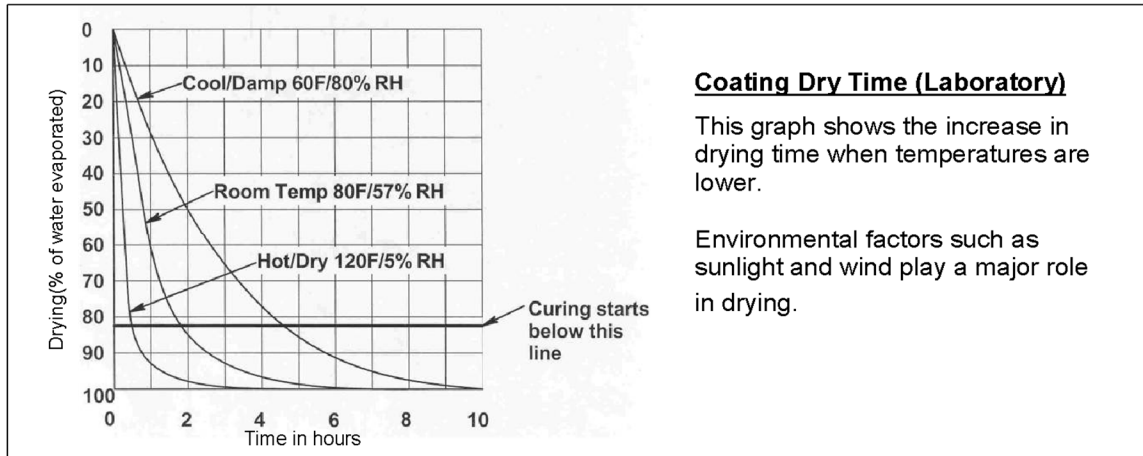
Application	Hot Dry Climate	Temperate/Winter Climate
Pedestrian only	3 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 200 ft ² (18.6m ²) per 5 gallon (20 Litre) unit	3 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 200 ft ² (18.6m ²) per 5 gallon (20 Litre) unit
Residential driveway	3 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 200 ft ² (18.6m ²) per 5 gallon (20 Litre) unit	3 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 200 ft ² (18.6m ²) per 5 gallon (20 Litre) unit
Vehicular traffic		
Up to 500 cars per day per lane	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit
500 to 1000 cars per day per lane	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit, plus one additional layer in the wheel paths
1000 to 2000 cars per day per lane	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit, plus one additional layer in the wheel paths	4 layers at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit, plus two additional layers in the wheel paths
2000 to 3000 cars per day per lane	4 passes at 600 ft ² (56m ²) per 5 gallon (20 Litre) unit for a net coverage of 150 ft ² (13.9m ²) per 5 gallon (20 Litre) unit, plus two additional layers in the wheel paths	No warranty is provided for traffic levels above 2000 cars per day per lane
	No warranty is provided for traffic levels above 3000 cars per day per lane	

1. Additional layers of StreetBond® SB150 coatings may be used to provide additional build thickness in high wear areas such as vehicle wheel paths and turning areas.
2. A maintenance program may be required for applications exposed to:
 - abrasive materials (such as salt and sand)
 - abrasive equipment (such as snow removal equipment)
 - Studded winter tires

3.7 OPENING TO TRAFFIC

Minimally, StreetBond® SB150 coating must be 100% dry and sufficient curing time must be allowed before traffic is permitted on the surface.

TABLE 6: COATING DRY TIMES (TYPICAL)



If StreetBond® coatings are applied when moisture cannot evaporate, then the coating will not dry. The drying and curing of StreetBond® coatings have a direct impact on performance.

SECTION 32 11 00 - PAVEMENT BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aggregate subbase
- B. Aggregate base
- C. Cement treated base
- D. Lime stabilization

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 01 50 50, Erosion Control
- C. Section 31 20 00, Earth Moving

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Investigation and Percolation Report City of El Segundo Recreation Park Renovation Project – Phase 1 by Converse Consultants, dated November 12, 2024.
- B. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. Caltrans Standard Specifications, 2015
 - 1. Section 24, Stabilized Soils
 - 2. Section 25, Aggregate Subbases
 - 3. Section 26, Aggregate Bases
 - 4. Section 27, Cement Treated Bases

1.4 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the City. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.
- D. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.
- E. Finish surface of material to be stabilized prior to lime treatment shall be in accordance with Caltrans Standard Specification Section 24, Stabilized Soils.
- F. Finish surface of the stabilized material after lime treatment shall be in accordance with Caltrans Standard Specifications Section 24, Stabilized Soils.
- G. Finish surface of cement treated base shall be in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.

- H. Do not project the finish surface of aggregate subbase above the design subgrade.
- I. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the City.
- C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBBASE

- A. Material: Class 2 in accordance with Caltrans Standard Specification Section 25, Aggregate Subbases.

2.2 AGGREGATE BASE

- A. Material: Class 2, 1 ½ inch maximum or ¾ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

2.3 CEMENT TREATED BASE

- A. Material: Class A maximum in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.

2.4 LIME STABILIZED SOILS

- A. Material: In accordance with Caltrans Standard Specification Section 24-2, Lime Stabilized Soil.

PART 3 - EXECUTION

3.1 GENERAL

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

- A. Do not place or compact subgrade if above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.3 AGGREGATE SUBBASE

- A. Spreading and Compacting: In accordance with Caltrans Standard Specification Section 25-1.03D, Spreading and 25-1.03E, Compacting.

3.4 AGGREGATE BASE

- A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.5 CEMENT TREATED BASE

- A. Proportioning and Mixing Plant-Mixed: In accordance with Caltrans Standard Specification Section 27-1.03D.

3.6 LIME STABILIZATION

- A. Lime stabilization shall conform to Caltrans Standard Specification Section 24, Stabilized Soils, and the following:
 - 1. Add lime in the amount specified by the Geotechnical Engineer.
 - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the Geotechnical Engineer.
 - 3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the Geotechnical Engineer. The second mixing shall occur at about 24 hours after the initial mixing.
 - 4. Compact and grade the lime mixed subgrade immediately after the second mixing.
 - 5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.
 - 6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in Caltrans Standard Specifications, Section 24.
 - 7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the Geotechnical Engineer.

3.7 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the City.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hot Mix Asphalt
- B. Tack coat
- C. Hot Mix Asphalt paving
- D. Hot Mix Asphalt overlay
- E. Speed bumps
- F. Asphalt curbs
- G. Pavement grinding
- H. Adjusting manholes, valves, monument covers and other structures to grade

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 31 20 00, Earth Moving
- C. Section 32 11 00, Pavement Base Course

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Investigation and Percolation Report City of El Segundo Recreation Park Renovation Project – Phase 1 by Converse Consultants, dated November 12, 2024.
- B. ASTM
 - 1. D979: Standard Practice for Sampling Bituminous Paving Mixtures
 - 2. D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
 - 3. D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
 - 4. D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
 - 5. D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
 - 6. D3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

- C. Caltrans Standard Specifications, 2015
 - 1. Section 20: Landscape
 - 2. Section 39: Asphalt Concrete
 - 3. Section 88: Engineering Fabrics
 - 4. Section 92: Asphalt Binder
 - 5. Section 94: Asphaltic Emulsions
 - 6. Section 96: Geosynthetics

1.4 DEFINITIONS

- A. ASTM: American Society for Testing Materials.
- B. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

- A. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- B. Thickness of hot mix asphalt: In-place compacted thickness of asphalt courses will be determined according to ASTM D3549.
- C. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.
 - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample may be taken for every 1000 square yard or less of installed pavement, but in no case will fewer than 3 cores be taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each hot mix asphalt mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Tack Coat: Minimum surface temperature of 60 F at application.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 F and rising at application.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 F at application.
 - 4. Reinforcing Fabric: Air temperature is 50 F and rising and pavement temperature is 40 F and rising.

PART 2 - PRODUCTS

2.1 HOT MIX ASPHALT

- A. Type A In accordance with Caltrans Standard Specifications Section 39-2, Hot Mix Asphalt.
- B. Hot Mix Asphalt Materials:
 - 1. Asphalt Binder: Grade PG 64-10 in accordance with Caltrans Standard Specification Section 92, Asphalt Binders.
 - 2. Tack Coat: Grade SS1 in accordance with Caltrans Standard Specification Section 94, Asphaltic Emulsions.
- C. Aggregates: 1 inch max gradation for virgin aggregate and recycled asphalt pavement (RAP) in accordance with to Caltrans Standard Specification Section 39-2.02, Type A Hot Mix Asphalt.
- D. Geosynthetic Pavement Interlayer: Paving Fabric in accordance with Caltrans Standard Specification Section 96, Geosynthetics.
- E. Soil Sterilant: In accordance with Caltrans Standard Specifications Section 20-5.03, Inert Ground Covers and Mulches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prepare subgrade per geotechnical recommendations.
- B. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- C. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- D. If necessary, perform subgrade preparation or remediation in accordance with Section 31 20 00, Earth Moving.

- E. Notify City in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.2 PAVEMENT GRINDING

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated.

3.3 SOIL STERILANT

- A. Furnish and apply to areas per manufacturer's specifications.

3.4 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

- A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving in accordance with Caltrans Standard Specification Section 39-2.01C(3)(b) and in accordance with Section 32 11 00, Pavement Base Course.
- B. Tack Coat: Apply uniformly and at specified rates between HMA layers, to vertical surfaces of curbs, gutters and construction joints, and to existing pavement, including planed surfaces, in accordance with Caltrans Standard Specification Section 39-2.01C(3)(f).
 - 1. Allow tack coat to cure undisturbed before paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 SURFACE PREPARATION FOR PAVEMENT AT HOT MIX ASPHALT OVERLAYS

- A. Pavement Irregularities: Level with hot mix asphalt, Type A, ½ inch max aggregate.
- B. Pavement Cracks:
 - 1. Less than ¼ inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
 - 2. Wider than ¼ inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.
- C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying binder of paving asphalt to existing surface.

3.6 GEOSYNTHETIC PAVEMENT INTERLAYER

- A. Place geosynthetic pavement interlayer in accordance with Caltrans Standard Specification Section 39-2.01C(3)g.

3.7 HOT MIX ASPHALT SPREADING AND COMPACTING EQUIPMENT

- A. Provide spreading and compacting equipment in accordance with Caltrans Standard Specification Section 39-2.01C(2).

3.8 HOT MIX ASPHALT PLACEMENT

- A. Place, spread and compact hot mix asphalt to required grade, cross section, and thickness in accordance with Caltrans Standard Specification Sections 39-2.01C(2), 39-2.01C(3), and 39-2.01C(8).
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Caltrans Standard Specification Sections 39-2.01C(4)
 - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
 - 2. Clean contact surfaces and apply tack coat.
 - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
 - 4. Offset transverse joints in successive courses a minimum of 24 inches.
 - 5. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.10 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact in accordance with Caltrans Standard Specification Sections 39-2.01C(2).
- B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D2041, but not less than 90 percent nor greater than 96 percent.
- C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 HOT MIX ASPHALT CURBS AND DIKES

- A. Construction: Place over compacted surfaces in accordance with Caltrans Standard Specification Section 39-2.01C(9). Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Shape: Place hot mix asphalt to curb cross section indicated.

3.12 SPEED BUMPS

- A. Construct speed bumps over compacted pavement surfaces in accordance with Caltrans Standard Specification Section 39-2. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Place asphalt concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.
- C. Compact speed bumps with 8 ton static roller.

3.13 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

- A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
 - 1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
 - 2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.
- B. Install grade rings or blocking as needed to raise cover to finish grade.
- C. Pour concrete collar:
 - 1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
 - 2. Top of Collar: Bottom of existing asphalt pavement.
 - 3. Apply tack coat to all exposed surfaces.
 - 4. Fill excavation with hot mix asphalt and, while still hot, compact flush with adjacent surface.

3.14 INSTALLATION TOLERANCES

- A. Hot Mix Asphalt Pavement:
 - 1. Course thickness and surface smoothness shall be in accordance with Caltrans Standard Specification Section 39-2.01A(4)(i)(iii)
 - 2. Total Thickness: Not less than indicated.
- B. Trench Patch:

1. Compacted surface: Within 0.01 foot of adjacent pavement.
2. Do not create ponding.

C. Adjust Covers:

1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
2. Do not create ponding.

END OF SECTION

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SECTION 32 13 16 - DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes colored and natural gray retardant finish concrete paving, concrete stairs, ramps, curbs and gutter and concrete bands, headers and finish for concrete site walls.
- B. Related Sections:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Section 07 92 00 "Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and asphalt paving or adjacent construction.

1.3 SUBMITTALS

- A. See section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. For each type of product indicated submit manufacturer's product data, specifications, typical installation details and other data to demonstrate compliance with the specified requirements for all manufacturer products.
 - 2. Statement of Mix Design: Submit (3) copies of Statement of Mix Design prepared by batch plant servicing Project for each load delivered to Project. Statement of Mix Design to contain following information:
 - a. Name, address, and telephone number of batch plant preparing statement of mix design.
 - b. Date of mix design.
 - c. Project location.
 - d. Contractor requesting load delivery.
 - e. Mix design number.
 - f. Integral color used.
 - g. Gradations for sand and aggregate.
 - h. Material weights, specific gravity, and absolute volumes.
 - i. Basis of testing, i.e. UBC 2605 D4 and Title 24 2604 D4.
 - j. Water/cement ratio.
 - k. PSI rating.
 - l. Signature of testing laboratory manager.
 - m. Signed stamp from registered Project structural engineer or architect LEED Submittals.
- C. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.
 3. Fiber reinforcement.
 4. Admixtures.
 5. Curing compounds.
 6. Applied finish materials.
 7. Bonding agent or epoxy adhesive.
 8. Joint fillers.
- D. Samples for Verification: To be determined by the mock-ups.
- E. Shop Drawings:
1. Indicate layout of joints.
 2. Submit shop drawings for reinforcing steel and accessories in accordance with ACI standards.
 3. Paving Jointing and Pour Sequence Plan - submit three full size bond prints of each paving sheet indicating the following:
 - a. Proposed layout of contraction, construction and isolation joints. Clearly delineate the three different joint types.
 - b. Layout of paving types as indicated on Drawing Paving Schedule. Give overall dimensions of each paving type.
 - c. Concrete pour sequence. Indicated sequence of paving pour installation.
- F. Qualification Data: For qualified Installer.

1.4 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
 2. Steel reinforcement and reinforcement accessories.
 3. Fiber reinforcement.
 4. Admixtures.
 5. Curing compounds.
 6. Applied finish materials.
 7. Bonding agent or epoxy adhesive.
 8. Joint fillers.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm and individuals trained and approved by manufacturer of decorative concrete paving systems with a minimum of fifteen consecutive years' experience. Provide written evidence to indicate successful experience in installing Intecrete or equivalent architectural concrete paving, or similar, on at least (5) projects with a combined installed square footage of at least 75,000 SF with (3) projects located within a 100 mile radius of Project site.
- B. ACI Certified Personnel:
1. Concrete Flatwork Finisher:

- a. Minimum of 1,500 hours of field experience having installed at least (5) projects containing Intecrete® architectural concrete paving.
 - b. Must be present during important stages of concrete production such as layout, formwork, or concrete placement and finishing.
 - c. Project must have a minimum of (1) ACI certified Concrete Flatwork Finisher at important phases of production.
 - d. Submit verification of current ACI certification.
- 2. Concrete Flatwork Technician:
 - a. Minimum of (1) ACI certified Concrete Flatwork Technician able to render technical assistance on project, if requested.
 - b. Submit verification of current ACI certification.
- C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.
- F. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- G. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
- H. Mockups:
 - 1. Prepare on-site paving and stair mock-ups as follows:
 - a. Prepare a minimum 8-foot square mock-up of each different paving type specified on Drawings. Label mock-ups (preferably on vertical side of mock-up) with specified paving type to facilitate mock-up review.
 - b. Construct mock-ups using identical concrete mix design, products, jointing, and methods of overall workmanship that will be employed during production.
 - c. Ensure that same crew preparing mock-ups will be responsible for production work.
 - d. Construct mock-ups in a protected location approved by Owner. Ideally mock-ups should be located as close to production work as possible to facilitate comparison review and be located in a sunny location.
 - e. Approved mock-ups will be used as standard for future production work review and assessment. Owner should be prepared to physically sign mock-up using a permanent black marker to attest Owner's approval of mock-up. Rejected mock-ups can remain on-site until removal of approved mock-ups is required.

- f. Original 6-inch or 12-inch concrete samples, if they were prepared for this project, will not be used in future production paving review once mock-ups have been approved.
 - g. Owner will incur costs to redo mock-ups if Owner requires design changes during mock-up review. Contractor will incur costs to redo mock-ups if Owner rejects mock-ups due to Contractor error such as incorrect concrete mix design or unacceptable appearance.
 - h. Protect approved mock-ups from damage during course of Work.
 - i. i. Clean mock-ups prior to Final Walkthrough for Acceptance to facilitate unencumbered comparison review by Owner between approved mock-ups and production work.
 - j. k. Remove mock-ups from site when directed by Owner.
2. Prepare site wall mock-ups as follows:
- a. Minimum 5-foot long mock-up of each specific Wall type indicated on Drawings.
 - b. Construct mock-ups using products, materials and workmanship methods identical to those that will be employed during production. Workmanship to exhibit finish, jointing, and edging.
 - c. Use same concrete mix that will be used during production.
 - d. Ensure that same personnel that prepared mock-ups will also install production work.
 - e. Construct mock-ups in a location approved by General Contractor.
 - f. Approved wall mock-ups will be standard for assessment for future production work.
 - g. Construct additional mock-ups at Contractor's expense if workmanship is responsible for mock-up rejection by Owner, however, Owner will incur costs to redo mock-up if Owner requests design changes during mock-up preparation.
 - h. Protect approved mock-ups during course of Work.
 - i. Remove mock-ups from site when directed by General Contractor.
- I. Preinstallation Conference: Conduct conference at Project site.
- 1. At least three weeks prior to ordering specified materials or the start of concrete work,
 - 2. Arrange a pre-installation meeting between the Contractor, Architect, Project superintendent, concrete supplier, and concrete finisher to review finishing techniques of
 - 3. Concrete, use of additives, application of curing compounds and coordination with other
 - 4. trades.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FLAT WORK FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves of a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 FORM MATERIALS

- A. Plywood:
 - 1. Exterior grade plywood panels, non-absorptive, providing a continuous, true, and smooth surface such as medium-density overlay (MDO), Class 1, or better, with mill-applied release agent and sealed edges.
 - 2. Form Joint Tape: Pressure-sensitive compressible foam tape.
 - 3. Form-Release Agent: Colorless form-release agent that will not bond with concrete surface or impair subsequent treatments of those surfaces.
- B. Structural:
 - 1. #2 Construction Grade S4S Douglas Fir minimum 1-1/2-inches thick, free of warping, loose knots, cupping, checks, bows, cracks, and other imperfections that would produce objectionable defects in finished work.
 - 2. Depth of forms to be same depth as concrete being placed.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: Grade 60 steel conforming to AS A615 and free of rust, dirt, grease or oils.
- B. Steel Tie Wire: 16-gauge plain cold-drawn steel conforming to AS A1064/A1064M and free of rust, dirt, grease or oils.
- C. Joint Dowel Baskets: Pre-manufactured dowel basket assembly to provide construction joint stability, eliminate tripping hazards, positive load transfer, maintain continuity of surface profile, reduce joint spalling, and reduce “checkerboard” pours, without prohibiting horizontal slab movement.
 - 1. PD3 Basket Assembly® by PNA Construction Technologies; www.pna-inc.com.
 - 2. PNA Square/Round Dowel Basket Assembly by PNA Construction Technologies; www.pna-inc.com
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.
- E. Steel Bar Mats:
 - 1. Grade 60 deformed steel bars assembled with clips conforming to AS A184 and free of rust, dirt, grease or oils.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type III or Type V. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F. Fly Ash content not to exceed 25% total concrete weight.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S uniformly graded. Provide aggregates from a single source.
 - 1. Maximum Aggregate Size: 1 inch (25 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
- F. Liquid Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Admixtures Inc.
 - c. Scofield, L. M. Company.
 - d. Solomon Colors, Inc.

2.5 CURING AND SEALING MATERIALS

- A. Amber, Aliphatic, Membrane-Forming Curing and Sealing Compound; manufactured for use with colored concrete.
 - 1. Admixtures Inc; Colorfull Clear Curing Compound.
 - 2. 1100-Clear by WR Meadows; www.wrmeadows.com.

2.6 RELATED MATERIALS

- A. Fine and Coarse Aggregate: Clean, hard, and durable washed concrete sand conforming to ASTM C33. Use same fine aggregate from single source throughout duration of Project. Refer to Paving Schedule on Drawings for sizing of coarse aggregate. Some paving types may require different coarse aggregate sizes
- B. Joint Fillers: ASTM D 5249, Type 2, flexible foam expansion joint in preformed strips.
 - 1. Products: W.R. Meadows; Seal Tight Cermar.

- C. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).
 - 1. ACC; Optimus.
 - 2. Grace, Topcast.

2.7 JOINT MATERIALS

- A. Construction Joints:
 - 1. Steel Slip Dowels: 5/8-inch-diameter smooth steel bars, free of dirt, grease, and oils.
 - 2. Plastic Dowel Sleeves: Encase 50 percent of each dowel in a Speed Dowel® plastic alignment sleeve to allow parallel lateral movement of each dowel.
 - a. Acceptable Manufacturers:
 - 1) Speed Dowel® by Greenstreak Group; www.greenstreak.com.

2.8 CONCRETE SEALER

- A. Low sheen, low VOC, penetrating sealer that exhibits superior resistance to stains, spills, and other contaminates.
- B. Acceptable Manufacturers:
 - 1. Repello® by Scofield; www.scofield.com.
 - 2. Siloxene PD® by Prosoco; www.prosoco.com.
 - 3. 511 Impregnator by Miracle Sealants; www.miraclesealants.com.

PART 3 - EXECUTION

3.1 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 2800 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 5 inches (125 mm). plus or minus 1 inch (25 mm).
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture in concrete as required for placement and workability.

- E. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. M)
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

3.2 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

3.3 SUBGRADE

- A. Subgrade to meet requirements of project's Geotechnical report.
- B. Water condition subgrade and compact to 90 percent relative compaction is placed over prior to placing concrete.
 - 1. Screed subgrade to a smooth plane.
 - 2. Ensure that utilities, including irrigation lines are buried and compacted.
 - 3. Keep subgrade damp prior to placing concrete.

3.4 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below decorative concrete work to identify soft pockets and areas of excess yielding.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.6 FORMWORK

- A. General:
 - 1. Construct forms accurately to dimensions, plumb and true to line and grade.
 - 2. Use forms that are strong, mortar tight, braced and tied so as to maintain position and shape during placing of reinforcing and concrete.
 - 3. Wavy surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will be rejected.
 - 4. Carefully verify and check forms for alignment and level as the Work proceeds.

5. Make needed adjustments or add additional bracing prior to pouring concrete.
- B. Formwork Material at Exposed Surfaces: Smooth metal, resin-coated plywood, or high-density overlay plywood which will provide an ultra-smooth surface.
- C. Tolerances for Exposed Concrete:
 1. Top of form units shall not vary more than 1/8 inch from a 10 feet long straight edge.
 2. Vertical faces shall not vary more than 1/8 inch from a 10 feet long straight edge.
- D. Joints:
 1. Construct forms and assemble them in such a manner so that joints occur at accepted locations.
 2. Seal joints to prevent leakage and provide exposed finish surfaces free of joint marks or any indication of where the form joints occurred.
- E. Corners:
 1. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed to face of concrete.
 2. Form exposed corners to produce square smooth, solid unbroken lines, unless indicated otherwise.
- F. Other Trade Requirements:
 1. Construct chases, slots and recesses as required.
 2. Locate inserts, anchor plates and other items to be embedded in concrete where required, properly place and securely anchor.
- G. Recesses and Openings: Provide as shown on the Drawings.
- H. Prior to Pouring Concrete:
 1. Thoroughly clean out forms to be used.
 2. Thoroughly wet wood forms where form coatings are not used.
- I. Removal of Forms:
 1. Do not remove supporting forms or shoring until concrete has sufficient strength to carry its own weight and other loads upon it.
 2. Remove forms only after concrete has attained at least 50% of its design compressive strength.
- J. Re-use of Forms:
 1. Do not reuse if there is any evidence of surface wear or tear which would impair quality of exposed finishes.
 2. Store formwork and form materials in such a manner as to prevent damage or distortion.
 3. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage to concrete finish.

3.7 REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

3.8 FORM TIES

- A. Exposed form ties will not be visible once the concrete wall is architecturally finished, however, form ties will still be required to construct wall.
- B. Internally disconnecting or removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete upon removal. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2-inches from the architectural concrete surface.
- C. Form ties to have a minimum working strength when fully assembled of at least 3,000 lbs.
- D. Adjust form ties in length so as to permit complete tightening of forms and of such type as to lean no metal closer than 1-inch to an exterior surface or closer than 1/2-inch to an interior surface.
- E. Do not fit form ties with lugs, cones, washers, or other device so as to act as a spreader within forms, or for other purposes that will leave a hole or depression larger than 7/8-inch in diameter back of exposed surface of concrete.
- F. Do not use wire or wood ties.
- G. Coat ties that are to be pulled from walls with cup grease or other approved material to facilitate efficient removal.
- H. Loosen tie rods that are to be entirely removed from walls 24 hours after concrete is poured. Remove all but a sufficient number of ties to hold forms in place.

3.9 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

- C. Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion as indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/16-inch- (5-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 1. Perform jointing with a new diamond tip circular saw.
 - 2. Joint Width: Per Drawings. Do not exceed 3/16-inch in width.
 - 3. Depth of sawcuts: 1/4th depth of slab.
 - 4. Sawcut joints in a straight line complete with no overcutting.
 - 5. Use a hand tool to sawcut up to vertical edges such as walls, steps, curbs and columns. No over cutting into vertical surfaces will be allowed.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

3.10 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side

forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- I. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.11 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
- C. Broom Finish:
 - 1. Prior to brooming, provide a floated finish.
 - 2. While the surface is still plastic, provide a uniform, broom-texture finish by pulling a fiber-bristle broom uniformly over the surface.
 - 3. Broom sidewalk paving along street in direction 90 degrees to street curb.
 - 4. Broom Service Area paving in direction 90 degrees to building walls.
 - 5. Provide texture to match the accepted mock-up finish.

3.12 RETARDANT CONCRETE FINISH

- A. Concrete Finish; after final floating:
 - 1. Retardant Finish: Roll with roller tamper and then immediately bullfloat in both directions. Immediately after initial floating, towel smooth with no indentions, apply retardant when surface has sufficient moisture in the surface.
 - 2. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - 3. Provide texture to match the accepted mock-up finish.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- B. Begin curing after finishing concrete but not before and applying retardant finish.
- C. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch (19 mm).
 - 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long, unlevel straightedge not to exceed 1/8 inch (3 mm).
 - 4. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
 - 5. Vertical Alignment of Dowels: 1/4 inch (6 mm).
 - 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
 - 7. Joint Spacing: 1/8 inches (3 mm).
 - 8. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - 9. Joint Width: 1/16 inches (1.5 mm).

3.15 FIELD QUALITY CONTROL

- A. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- B. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- C. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.16 STAINING AND SEALING

- A. Allow Stratified or Sedimentary TM to dry sufficiently before applying specified stain or sealer.
- B. Do not apply sealer if air temperatures are below 50 degree F or above 90 degrees F.
- C. Once the concrete surface has been sealed, protect surface until fully dried.

- D. Follow manufacturer's directions for stain or sealer application.

3.17 REPAIRS AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 16

SECTION 32 13 18 - CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Materials for portland cement concrete
- B. Aggregate and aggregate grading for portland cement concrete
- C. Water for portland cement concrete
- D. Admixtures for portland cement concrete
- E. Proportioning for portland cement concrete
- F. Mixing and transporting portland cement concrete
- G. Formwork for cast in place portland cement concrete
- H. Embedded materials for portland cement concrete
- I. Steel reinforcement for portland cement concrete
- J. Placing and finishing portland cement concrete
- K. Curing portland cement concrete
- L. Protecting portland cement concrete

1.2 RELATED SECTIONS

- A. Section 32 12 16, Asphalt Paving

1.3 RELATED DOCUMENTS

- A. ASTM Standards
 - 1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. C94, Standard Specification for Ready-mixed Concrete
 - 4. C150, Standard Specification for Portland Cement
 - 5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
 - 6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 7. C494, Standard Specification for Chemical Admixtures for Concrete.
 - 8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement

9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- B. Caltrans Standard Specifications, 2018
1. Section 51: Concrete Structures
 2. Section 73: Concrete Curbs and Sidewalks
 3. Section 90: Concrete

1.4 DEFINITIONS

- A. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

- A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- B. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
1. Provide City's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - c. Statement of type and amount of any admixtures.

2. Provide City's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

- A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.

2.2 AGGREGATE AND AGGREGATE GRADATION

- A. General: Fine and coarse aggregates shall be $\frac{3}{4}$ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.3 WATER

- A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

- A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
 - 1. Air-Entraining Admixture: ASTM C260/C260M
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A
 - 3. Retarding Admixture: ASTM C494/C494M, Type B
 - 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
 - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
 - 7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
 - 1. Curbs, Gutters, and Sidewalks: Minor concrete.
 - 2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
 - 3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
 - 4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
 - 5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
 - 1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining:
½ inch
 - 2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

- B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 CURING AND SEALING MATERIALS

- A. Curing Compounds:
 - 1. Concrete surface repellent-vertical and/or flatwork: Repello surface treatment, invisible chemical treatment barrier system.

2.9 FORMS

- A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.
- B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.10 PRECAST CONCRETE STRUCTURES

- A. Conform to the following Sections of Caltrans Standard Specifications:
 - 1. 51-7, Minor Structures
 - 2. 70-5.02, Flared End Sections

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.

- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the City's Representative, submit details and calculations to the City's Representative. The City's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the City's Representative.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be

done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:

1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
1. Surfaces exposed to water: 4 inches.
 2. Surfaces poured against earth: 3 inches.
 3. Formed surfaces exposed to earth or weather: 2 inches.
 4. Slabs, walls, not exposed to weather or earth: 1 inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the City's Representative.
- B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the City's Representative. Continue

vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

- E. Concrete in certain locations may be pumped into place upon prior approval by the City's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

3.9 DECORATIVE SURFACING CONSTRUCTION

- A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

3.10 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.

- D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
 - 1. Elevation: $\frac{1}{4}$ inch.
 - 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 - 3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: $\frac{1}{4}$ inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: $\frac{1}{2}$ inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel $\frac{1}{4}$ inch per 12 inches.
 - 8. Joint Spacing: 3 inches, unless otherwise indicated.
 - 9. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 - 10. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

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SECTION 32 13 75 - CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course
- C. Section 32 13 13, Concrete Pavement
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Investigation and Percolation Report City of El Segundo Recreation Park Renovation Project – Phase 1 by Converse Consultants, dated November 12, 2024.
- B. American society for Testing and Materials (ASTM)
 - 1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- C. Caltrans Standard Specifications, 2015
 - 1. Section 51: Concrete Structures
 - 2. Section 72: Slope Protection
 - 3. Section 73: Concrete Curbs and Sidewalks
 - 4. Section 90: Concrete

1.4 DEFINITIONS

- A. ASTM: American Society for Testing Materials
- B. ACI: American Concrete Institute

1.5 SUBMITTALS

- A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.

- B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the City. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
- B. Certifications:
 - 1. Provide City at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - 2. Settlement of type and amount of any admixtures.
 - 3. Provide City, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
 - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
 - 2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.
- B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
 - 1. Compressive Strength:
 - a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
 - b. Curbs & Gutters: 3500 psi, minimum at 28 days.
 - 2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
 - 3. Water/Cement Ratio: 0.5

2.3 CURBS AND GUTTERS FORMS

- A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.4 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.
- B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
 - 1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: 1/4 inch

2.5 REINFORCEMENT AND DOWELS

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.
- B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.
- C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

- A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.3 SOIL STERILANT

- A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.4 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches
 - 2. Surfaces poured against earth: 3 inches
 - 3. Formed surfaces exposed to earth or weather: 2 inches
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the City. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the City. When this procedure requires redesign of the mix, such redesign shall be

submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.8 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.
- C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.9 FINISHING CONCRETE

- A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
 - 1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
 - 2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave edge forms in place at least 24 hours after pouring.

3.11 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A cold joint to the existing curb is not acceptable.

3.12 FIELD QUALITY CONTROL

- A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.13 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

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SECTION 32 14 00 - SLURRY SEAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Contractor shall perform all work associated with Slurry Seal as shown and as specified herein including all labor, materials, equipment supplies, and facilities associated with providing a finished product satisfying all the requirements of the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit, at least seven (7) working days before slurry seal placement commences, a laboratory report of test results and proposed mix design covering the specific materials to be used on the project. The percentage of asphaltic emulsion proposed in the mix design shall be within the percentage range specified herein.

1.3 RELATED SECTIONS

- A. Section 32 17 23, Pavement Markings

1.4 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, 2015
 - 1. Section 37: Bituminous Seal

PART 2 - PRODUCTS

2.1 SLURRY SEAL

- A. Slurry seal shall be Type II in accordance with Section 37-3 of the Caltrans Standard Specifications with the exceptions noted in these specifications.

2.2 AGGREGATE

- A. Aggregate for Type II slurry seal shall be in accordance with Section 37-3.02A and 37-3.02B of the Caltrans Standard Specifications.

2.3 ASPHALTIC EMULSION

- A. Asphaltic emulsion shall be Grade PMCQS1h, complying with Section 37-3B(3) of the Caltrans Standard Specifications.
- B. The polymer within the asphalt emulsion shall be Neoprene, SBR, EVA, or SBS or approved equal. Solid polymer such as EVA, SBS, or approved equal shall be adequately blended into the asphalt prior to the asphalt prior to emulsification. If latex such as Neoprene, SBR or similar is used, the latex shall be "co-milled" into the

emulsion through the water phase during manufacturing. Each load of polymer asphaltic emulsion shall have a certificate from the asphalt emulsion manufacturing indicating that either asphalt blending or "co-milling" process is used. The certificate shall also state the percentage of the solid rubber polymer added, by weight of the asphalt, as well as the composition of the polymer. The addition of latex to the emulsion after emulsion manufacturing is prohibited.

2.4 WATER AND ADDITIVE

- A. Water shall be of such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work. If necessary for workability, a set-control agent that will not adversely affect the slurry seal may be used.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The application of Type II slurry seal shall conform to Section 37-3.03 of the Caltrans Standard Specifications with the exceptions noted in these Specifications.
 - 1. The slurry seal shall be placed at a rate to produce 10 to 13 pounds of aggregate per square yard for Type II slurry, as required in these Specifications. The complete mixture shall be such that the slurry seal mixture has proper workability and will permit traffic flow within two (2) hours after placement without the occurrence of bleeding, raveling, polishing, separation, or other distress within 30 days after its placement.
 - 2. Asphaltic emulsion shall be added at a rate of between 10 to 15 percent by weight of the dry aggregate. The extract rate will be determined by the Engineer. The quantity of asphaltic emulsion to be used in the slurry seal mixture will be determined by the design asphalt binder content, as approved by the Engineer, and the asphalt solid content of the asphaltic emulsion furnished.
 - 3. The Contractor shall sweep all slurry seal streets seven (7) days after the application of slurry seal with a power sweeper.

3.2 PROPORTIONAL MIXING

- A. The proportional mixing of slurry seal shall conform to Section 37-3.03B and 37-3.03C of the Caltrans Standard Specifications.
- B. The mixer shall thoroughly blend all materials to form a homogenous mass before leaving the mixer.

3.3 SURFACE PREPARATION

- A. All existing striping and pavement markers shall also be removed prior to the application of the slurry seal. The slurry shall be applied within 72 hours after the removal of pavement striping marker.

- B. The complete street surface shall be power swept from face of curb to face of curb prior to the application of slurry seal. The Contractor shall provide cleaning method necessary to remove all dirt, vegetation, and loose materials from the pavement.
- C. All material gathered shall be properly disposed of by the Contractor. The Contractor shall remove all plant material growing in the street or on the interface of the asphalt surface with the lip of concrete gutter prior to placing slurry.
- D. Immediately preceding the slurry seal application, the Contractor shall cover all grates, slotted manholes, and other appurtenances on the pavement that would allow the entry of slurry; cover all manhole covers, water and gas valve box covers, monuments boxes, grates and other exposed facilitates with plastic oil resistant construction paper secured by tape or adhesive. The Contractor prior to the final set of the slurry shall uncover all covered manholes, valves, grates and boxes. All uncovered items shall be clean and meet the requirement of the Project Inspector.
- E. All catch basin grates and hoods adjacent to the work or within 50 feet shall be covered to prevent slurry from entering the catch basin.

3.4 SPREADER BOX

- A. The slurry mixture shall be spread by means of a controlled spreader box conforming to Section 37-3.03C of the Caltrans Standard Specifications.
- B. The spreader box shall be clean and free of all slurry seal and emulsion at the start of each working shift.

3.5 SAND BLOTTER

- A. A sand blotter shall be spread at selected driveways, intersections, and where required by the Engineer to accommodate pedestrian or vehicular traffic until the slurry set.

3.6 APPLICATION OF SLURRY SURFACE

- A. The surface shall be fogged with water directly preceding the spreader. The slurry mixture shall be of the desired consistency when deposited on the surface. Total time of mixing shall not exceed four (4) minutes. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that the complete coverage is obtained. No lumping, balling or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement. No excessive breaking of the emulsion will be allowed in the spread box. No streaks such as those caused by oversize aggregate will be left in the finished pavement.
- B. The entire pavement, including the area around curb return shall be covered from gutter lip to gutter lip. The ends of slurry seal streets shall be a clean, straight line created by placing 15 lb felt paper with a 30 in. minimum width to create the line.

- C. Longitudinal joints must correspond with lane lines. You may request other longitudinal joint patterns if they do not adversely affect the slurry seal.
- D. Spread slurry seal in full lane widths. Do not overlap slurry seal between adjacent lanes more than 3 inches.
- E. Use kraft paper at transverse joints and over previously placed slurry seal to prevent double placement. Remove the paper after use. Use hand tools to remove spillage.
- F. No excessive buildup, or unsightly appearance shall be permitted on longitudinal or transverse joints. Burlap drags shall be used and changed daily.
- G. Approved squeegees shall be used to spread slurry in non-accessible areas to the slurry mixer. Care shall be exercised in leaving no unsightly appearance from handwork.
- H. Slurry application will be stopped to allow sufficient time to allow slurry to cure prior to opening streets to traffic. Protect the slurry seal from damage until it has cured.
- I. All gutter spills must be cleaned immediately.

3.7 WEATHER LIMITATIONS

- A. The slurry seal shall not be applied when either atmospheric or pavement temperature is 55 degrees Fahrenheit and falling but may be applied when either the atmospheric or pavement temperature is above 45 degrees Fahrenheit and rising. The slurry seal shall not be applied during periods of abnormally high relative humidity.

3.8 SLURRY REPAIR

- A. In the event that the applied slurry seal surface violates the project requirements or has the following conditions:
 - 1. Tire or wheel marks
 - 2. Longitudinal ridges
 - 3. Picked up or raveled areas
 - 4. Transverse ridges or bumps
 - 5. Washboarding or excessively rough sand blotters
- B. The slurry seal shall be repaired as follows:

1. The slurry seal shall be removed by a "PENHALL PROFILER" or equal and a full lane width pass of slurry seal applied in full compliance with these specifications.
2. The Engineer may omit removal of the affected slurry seal if it would not affect the repair.

3.9 STRIPING

- A. Temporary striping and legends shall be placed on the newly slurry sealed streets prior to the release of streets to traffic. These materials must be submitted to the Engineer for approval prior to installation.
- B. Permanent striping shall be installed after seven (7) days but no later than ten (10) days after the slurry seal is complete in accordance with Section 32 17 23, Pavement Markings.

END OF SECTION

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SECTION 32 17 13 - PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes concrete precast wheel stops.

1.2 RELATED SECTIONS

- A. Section 01 00 00, Supplemental General Requirements

1.3 SUBMITTALS

- A. Follow submittal procedure outlined in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Submit product data for each type of product.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 2500 psi minimum compressive strength, 5½ inches high by 7½ inches wide by 48 inches long (or length as shown on plans). Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
 - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
 - 2. Mounting Hardware: Galvanized-steel dowel, ½ inch diameter, 24 inch minimum length.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Oldcastle Precast
 - 2. Bertelson Precast
 - 3. Barco Products, or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

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

3.2 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Removal of existing traffic stripes and pavement markers
- B. Removal of existing signs
- C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings
- D. Materials and application for traffic stripes and pavement markings
- E. Materials and application for pavement markers
- F. Traffic control signs and street name signs
- G. Object markers
- H. Survey monuments

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, 2015
 - 1. Section 78, Incidental Construction
 - 2. Section 81, Miscellaneous Traffic Control Devices
 - 3. Section 82, Signs and Markers
 - 4. Section 84, Markings
- B. Caltrans Standard Plans, 2015
 - 1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
 - 2. Plan A24A and A24B: Pavement Markings Arrows
 - 3. Plan A24C: Pavement Markings, Symbols and Numerals
 - 4. Plan A24D: Pavement Markings, Words
 - 5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
 - 6. Plan A24F: Pavement Markings, Crosswalks
 - 7. Plan A73A: Object Markers
 - 8. Plan A73B: Markers

9. Plan A73C: Delineators, Channelizers and Barricades
 10. Plan A74: Survey Monuments
 11. Plan RS1: Roadside Sign, Typical Installation Details No. 1
 12. Plan RS2: Roadside Sign, Wood Post - Typical Installation Details No. 2
 13. Plan RS3: Roadside Sign, Laminated Wood Box Post - Typical Installation Details No. 3
 14. Plan RS4: Roadside Sign, Typical Installation Details No. 4
- C. The State of California Traffic Manual, 2014
- D. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.
- E. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.4 SUBMITTALS

- A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:
1. Traffic paint
 2. Pavement markers and adhesives
 3. Reflectorized markers and posts

1.5 QUALITY ASSURANCE

- A. Deliver certificates showing conformance with this specification to the City's Representative with each shipment of materials and equipment to the Project site.
- B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

- A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the City's Representative.
- B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

- A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.

- B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.
- C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

- A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.3 TRAFFIC CONTROL SIGNS

- A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.
- B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.
- C. Posts:
 - 1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
 - 2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.
- D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.
- E. Post Foundations: Conform to Caltrans Standard Plans.

2.4 STREET SURVEY MONUMENTS

- A. General: In accordance with Caltrans Standard Specification Section 78-2, Survey Monuments, except that the marker disk will not be furnished. Marker disk shall be 2 inch diameter solid brass with a 2 ¾ inch shaft, "Lietz No. 525" or approved equal.
 - 1. Portland Cement Concrete: In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

- A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.
- B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.
- C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.
- D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated. As such, when grinding or other methods approved by the City's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the City's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the City's Representative has approved the work plan.
- E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

- A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.
- B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.5 TRAFFIC CONTROL SIGNS

- A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.
- B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.
- C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.6 STREET SURVEY MONUMENTS

- A. Install Survey Monuments in accordance with Caltrans Standard Specification Section 78-2.03, Construction and Caltrans Standard Plan A74, except that the marker disk will not be furnished. Exact point in marker to be determined by an accurate survey and placed by a California Licensed Land Surveyors in accordance with the Professional Land Surveyors' Act.

3.7 PROTECTION

- A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.
- B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.8 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

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SECTION 32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. The requirements of the “General Conditions of the Contract” and of Division 1, “General Requirements”, shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.2 SCOPE OF WORK

- A. Furnish all labor, material, equipment and services necessary to provide site furnishings, complete in place, as shown on the Drawings or in this Specification.
- B. Related work:
 - 1. Site Concrete
 - 2. Planting
 - 3. Plumbing
 - 4. Electrical

1.3 SUBMITTALS

- A. Submit Manufacturers’ catalogue cuts or shop drawings indicating size, materials, finishes and quantities of items being supplied.
- B. Submit one color sample for each product. Color sample shall be of final material.

1.4 COORDINATION

- A. The Contractor shall coordinate his work with other trades.

PART 2 - PRODUCTS

2.1 TRASH/ASH URN

- A. Trash and recycle receptacles:
 - 1. Material: Powder coated metal.
 - 2. Color and finish: Body - “Fog”, Lid – “Lol Sky Blue”.
 - 3. Model number: “Rockford”, Top Opening with locking lid, freestanding
 - 4. Manufacturer: LandcapeForms (818) 541-6691.

2.2 BOTTLE FILLER

- A. ADA Outdoor vandal-resistant stainless steel pedestal bottle filler
- B. Color: Silver
- C. Manufacturer: HAWS (888) 640-4297

2.3 BASKETBALL POST

- A. “Thor Platinum”.
- B. Color: Black.
- C. Model number: 3610.
- D. Manufacturer: Pro-Dunk (888) 600-8545.

2.4 BIKE RACK

- A. “Heavy Duty Winder” galvanized and powder coated steel.
- B. Color: Black.
- C. Model numbers: HW238-3-IG-G (single bike) and HW238-7-IG-G (7-bike).
- D. Manufacturer: Madrax (800) 448-7931.

2.5 VOLLEYBALL POST SLEEVE

- A. SKU: POP-SLEEVE.
- B. Color/finish: Anodized aluminum with powder coated aluminum cap.
- C. Manufacturer: VolleyballUSA.com (800) 494-3933.

2.6 FOOTINGS AND HARDWARE

- A. Footings and hardware for secured installation.
- B. Submit shop drawings for review.

2.7 MISCELLANEOUS

- A. Anchors and adhesives required for installing and attaching the furnishings.

PART 3 - EXECUTION

3.1 DIMENSIONS

- A. Dimensions shall be certified at the job site to insure proper placement, and fit of the equipment in the allotted areas.

3.2 INSTALLATION

- A. Furnishings shall be installed per Manufacturer’s recommendations, unless otherwise noted on Drawings or Specification.

- B. Work shall be set plumb and level, true to line and shall present a neat and finished appearance.
- C. Set each item in its correct place, fastening it, connecting it, or incorporating it into other portions of the work.
- D. Test and operate equipment to assure proper function.

3.3 PROTECTION

- A. Adequately protect all work from damage by subsequent construction operations. Damaged work shall be replaced.

3.4 CLEAN-UP

- A. The Contractor shall at all times keep the premises free from accumulation of waste materials and rubbish caused by his employees.
- B. Upon completion of work, rubbish and excess materials are to be removed from the site, leaving the areas acceptably clean.

END OF SECTION 32 33 00

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes automatic-control irrigation system as shown on the Drawings and as follows:
 - 1. Trenching
 - 2. Piping and Fitting
 - 3. Valving
 - 4. Assemblies
 - 5. Automatic Controllers
 - 6. Specialties
 - 7. Wiring
 - 8. Sprinklers
 - 9. Cleanup
 - 10. Connections to existing mains or municipal water systems.
- B. Related work:
 - 1. Section 32 01 90: Landscape Maintenance
 - 2. Section 32 91 19: Finish Grading
 - 3. Section 32 90 00: Landscape Planting
- C. Definition: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 QUALITY ASSURANCE AND REQUIREMENTS

- A. Permits and Fees: The Contractor shall obtain and pay for any normally required and permits, fees and inspections as required.
- B. Manufacturer's Directions: Manufacturer's directions and detailed Drawings shall be followed in cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the Drawings and Specifications.
- C. Ordinances and Regulations: Any local, municipal and state laws, and rules and regulations governing or relating to any portion of this work, are hereby incorporated into and made a part of these Specifications and their provisions shall be carried out by the Contractor. Anything contained in these Specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these Specifications and Drawings shall take precedence.
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

1.3 SUBMITTALS

A. Material List

1. Furnish the articles, equipment, materials, or processes specified by name in the Drawings and Specifications per requirements of Division 1 or the General Provisions. No substitutions will be allowed without prior written approval by the Architect.
2. Submit a complete materials list to Architect prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used according to example as follows:

ITEM	DESCRIPTION	MANUFACTURER	MODEL NO.
1	Backflow Preventer		
2	Controller		
3	Isolation Valve		
4	Etc.		

3. Irrigation submittals must be specific and complete. All items must be listed and should include solvent and primer, wire, wire connectors, valve boxes, etc. No copies of manufacturer's literature (catalog cuts) are required as submittal information.
4. Equipment or materials installed or furnished without prior approval of the Architect may be rejected and the Contractor required to remove such materials from the site at his own expense.
5. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the Drawings and Specifications on the basis of the information or samples submitted.

B. Record Drawings

1. Refer to Division 1 or General Provisions.
2. Record Set During the Work: At site, maintain not less than one complete set of Drawings as a Field Record Set. Record by dimensioning from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
 - a. Connection to existing water lines.
 - b. Gate valves.
 - c. Routing of sprinkler pressure lines (dimension maximum 100' along routing).
 - d. Sprinkler control valves.
 - e. Routing of control wiring.
 - f. Quick-coupling valves.
 - g. Items specified under Division 1 or as directed by the Architect.

C. Final Record Drawings:

1. Prior to substantial completion, the Architect will order for the Contractor, at the Contractor's expense, one complete set of reverse-reading, reproducible mylar transparencies.
 2. The Contractor shall transfer recorded changes in the work indicated on the field set to the reproducible set, neatly and clearly, technically correct, and drafted in ink by a skilled draftsman.
 3. On or before the date of the final inspection, the Contractor shall deliver the corrected and completed reproducible plans to the Architect with a transmittal containing the date, project title and number, Contractor's name, address and authorized signature.
 4. Delivery of the reproducible plans will not relieve the Contractor of the responsibility of furnishing required information that may be omitted from the prints.
- D. Controller Charts:
1. Record Drawings shall be approved by the Architect before controller charts are prepared.
 2. Provide one controller chart for each controller supplied. The chart shall show the area controlled by the automatic controller and shall be the maximum size that the controller door will allow.
 3. The chart shall be a reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
 4. The chart shall be a blackline or blue-line ozalid print and a different color shall be used to indicate the area of coverage for each station.
 5. When completed and approved, the chart shall be hermetically laminated between two pieces of plastic, each piece being minimum 10 mils thick.
 6. These charts shall be completed and approved prior to final inspection of the irrigation system.
- E. Operation and Maintenance Manuals:
1. Prepare and deliver to Owner within 10 days prior to completion, three hardcover ring binders with the following in each:
 - a. Index
 - b. Guarantee statement.
 - c. Address and phone number of Contractor
 - d. Catalog and parts sheets on every material and equipment installed under this Contract with name, address and phone numbers of manufacturers and local representatives.
 - e. 11" x 17" color copy of controller charts (not laminated).
 - f. Complete operating and maintenance instructions on all major equipment.
- F. In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Architect at the conclusion of the project that this service has been rendered.
- G. Extra Equipment to be Furnished:
1. Furnish extra materials described below (match products installed), packaged with protective covering for storage and identified with labels describing contents.
 - a. Special Tools: Two sets of special tools required for removal, disassembling and adjusting each type of sprinkler, drip emitter, and valve on the project
 - b. Valve Keys: Two five-foot valve keys for operation of gate valves 3" or larger.

- c. Quick Coupler Keys: Two quick-coupler keys and matching hose swivels for each type of quick coupling valve installed.
- d. Drip Tube Units: Equal to 10 percent of amount installed for each type indicated, but no fewer than 10 units.
- 2. The above-described equipment shall be turned over to the Owner at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received material must be shown to Architect.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings.
 - 1. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point.
 - 2. Do not drop PVC pipe on hard surfaces.
 - 3. Any section of pipe that has been dented or damaged is to be discarded.
 - 4. If damaged material is installed, it shall be replaced with new material.

1.5 WARRANTY

- A. Contractor shall fully warrant and agree to replace any poor, inadequate or defective materials and workmanship for one year from date of acceptance of completed Irrigation System. The Architect shall be the sole judge of the acceptability of materials or workmanship.
- B. Replacement: Materials found to be defective, missing or in poor condition during the warranty period shall be replaced immediately. The Architect shall be the sole judge as to the condition of material. Material to be replaced during the warranty period shall be replaced by the Contractor within 15 days of written notification by Owner.

1.6 PERFORMANCE REQUIREMENTS

- A. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100% head-to-head coverage in all spray and rotor zones, unless otherwise indicated.
- B. Explanation of Drawings
 - 1. Drawings are diagrammatic and indicative of the work to be installed. All offsets, fittings, sleeves, etc., which may be required, may not be indicated. Carefully investigate the structural and finished conditions affecting all of the work and plan the work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, architectural features, drainage systems, or hardscape construction.
 - 2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences, or discrepancies in area dimensions exist that might not have been considered in the engineering.
 - a. Any discrepancy in Drawings shall be brought to the attention of the Architect. Contractor assumes full responsibility for work installed without clarification.
 - 3. The final location and exact positioning of automatic controllers, backflow prevention assemblies, gate valves, pressure regulators, or other equipment shall be approved by the Owner's authorized representative prior to installation.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use only new materials of brands and types noted on the Drawings, as specified herein, or approved equivalents.

2.2 PIPE

- A. Pressure supply lines 1 1/2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.
- B. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.3 POLY VINYL CHLORIDE (PVC) PIPES, TUBES & FITTINGS

- A. PVC pipe, tubes & fittings shall be of the class rating or schedule rating designated on the contract Drawings.
- B. PVC pipe shall continuously bear the following markings:
 - 1. Nominal pipe size.
 - 2. PVC Schedule or class.
 - 3. Type of plastic material in standard code
 - 4. Pressure rating in psi
 - 5. SDR for class rated pipe
 - 6. ASTM designation
 - 7. National Sanitation Foundation (NSF) approval.
 - 8. Manufacturer's name or trademark
 - 9. Date of extrusion.
- C. Schedule rated PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785. Schedule rated pipe shall meet requirements as set forth in Federal Specification PS-21-70 (solvent weld pipe).
- D. PVC Fittings, Solvent and Primer:
 - 1. For schedule rated pipe, fittings shall correspond to the same schedule rating.
 - 2. PVC solvent-weld fittings shall be Type 1, Grade I, NSF approved, conforming to ASTM test procedure D-2466.
 - 3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.
 - 4. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of the type prescribed by the pipe manufacturer. Installation methods shall be according to ASTM D-2885

2.4 BRASS PIPE AND FITTINGS:

- A. Where indicated on the Drawings or required by Code, use red brass screwed pipe conforming to ASTM B43.
- B. Fittings shall be red brass conforming to Federal Specification #WW-P-460.

2.5 BACKFLOW PREVENTION DEVICE:

- A. Backflow preventers shall be one of the approved reduced pressure principle devices listed by the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 North 7th Street, Mailing Station (MS) 92, P.O. Box 942732, Sacramento, CA 94234-7320.
- B. Backflow preventers shall be factory assembled and shall include two (2) check valves, one (1) pressure differential relief valve, two (2) shut-off valves, and four (4) test cocks. Backflow preventer and valves shall be the same size as the pipeline in which they are installed, unless otherwise shown on the plans.
- C. Backflow preventer shut-off valves shall be manufactured from iron or bronze and shall be either resilient wedged gate valves, resilient seated and fully proted ball valves, or resilient seated butterfly valves. Threaded type shut-off valves shall be provided with a union on one side of each valve. Unions shall be brass or malleable iron.
- D. Backflow preventer enclosure shall be constructed of stainless steel or cold-rolled steel, and shall be of expanded metal mesh or tube and wire construction, as manufactured by Strongbox, All-Spec,

2.6 VALVES

- A. Isolation Valves:
 - 1. Manifold Ball Valves Smaller than 3":
 - a. Schedule 80 PVC true union ball valves
 - b. 150 PSI at 73°
 - c. Full ported
 - d. Manufacturers: Chemtrol Division of Nibco Inc. model Tru-Bloc, King Bros., Spears model Multi-Featured Industrial Valve, or equal.
 - 2. Mainline Gate Valves Smaller than 3":
 - a. Brass body
 - b. Class 125 threaded
 - c. Non-rising stem
 - d. Solid wedge disc gate valve with cross handwheel
 - e. Manufacturers: Nibco T-113-K, or equal.
- B. Quick-Coupling Valves: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
- C. Automatic Electric Control Valves:
 - 1. Shall be as called out on Drawings and details.
 - 2. Normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.
 - 3. Provide and install one control valve box for each electric control valve.

2.7 CONTROL WIRING:

- A. Connections between the automatic controllers and the electric control valves shall be made with direct burial #14 AWG - UF 600 volt copper wire manufactured for irrigation system use.
- B. Use a different color wire for each automatic control valve.
- C. Common wires shall be white with a different color stripe for each automatic controller when multiple controllers are required.
- D. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.
- E. All control wire splices shall be made with waterproof wire connectors. Manufacturers: Spears Model No. DS-500 Dri-Splice, King Safety Products King 6 Blue, or approved equal. Use one splice per connector sealing pack.

2.8 TRACER WIRE:

- A. #12 gauge copper wire.

2.9 AUTOMATIC CONTROLLERS (BATTERY):

- A. Shall be of the size and type shown on the Drawings.

2.10 VALVE BOXES

- A. Plastic Valve Boxes (to be used when valve is in planting areas):
 - 1. For isolation valves, quick coupler valves, controller wire splices, or drain valves, use:
 - a. 10" diameter x 10" deep round box, Carson #910-4B, NDS Professional Series #212BC, or approved equivalent.
 - b. Use min 10" diameter extensions to achieve proper depth below assembly.
 - c. Lid shall be T-form, bolt-down type.
 - d. Label: heat brand lid with the text "IRR" in block letters.
 - 2. For Remote Control Valves, use
 - a. 11" x 17" rectangular box by Carson #1419-12-4B, NDS Professional Series #214BC, or approved equivalent.
 - b. Use 11" x 17" valve box extensions to achieve proper depth below assembly.
 - c. Lid shall be T-form, bolt-down type
 - d. Label: heat-brand lid with the text "RCV" and the valve number in block letters.
 - 3. Brand boxes with a commercially produced branding iron, as manufactured by BrandNew Industries, Inc. (800) 964-8251, or equal.
- B. Concrete Valve Boxes (to be used when valve is in pavement):
 - 1. For isolation valves, quick coupler valves, controller wire splices, or drain valves, use
 - a. 9" diameter x 24" deep round box, Brooks Products #9 series, Christy Concrete Products Model #B3C or approved equivalent.
 - b. Lid shall be cast iron and
 - c. Label: permanently mark with the text "IRR" in block letters.
 - 2. For Remote Control Valves, use

- a. 13" x 19" rectangular box by Brooks Products #3 series, Bes Concrete Products #C22E, or approved equivalent. Use 11" x 17" valve box extensions to achieve proper depth below assembly.
- b. Lid shall be bolt-down type, cast iron
- c. Label: permanently mark lid with the text "RCV" and the valve number in block letters.

2.11 DRIP IRRIGATION EQUIPMENT

- A. Flexible tubing shall be fabricated from virgin Polyethylene resin as manufactured by Union Carbide DFDA 7510, with a minimum of 2% carbon black, specifically designed for drip irrigation use and conforming to the requirements of Specification ASTM D 1248 for Type I, Class C, Category 4 Grade P14, and to ASTM D-3350 for PE 122111C.
- B. Pressure rating of tubing shall be as defined in Standard ASAE S435. Burst strength shall be minimum 50 psi at 176 degrees F for 4,200 hours.
- C. Single and multiple outlet emitters shall be a self-flushing and pressure compensating type. Emitter bodies shall be constructed of durable UV resistant plastic. Regulating diaphragms shall be constructed of silicone rubber.
- D. In-line emitters shall have self-cleaning emitters impregnated with Treflan root growth inhibitor. Manufacturer: Toro; Model # DL2000.
- E. Flush valve: Toro FCH-H.
- F. Air / vacuum relief valve: Toro YD-500-34.
- G. Screen filters shall be as manufactured by Amiad Inc. with pressure rating of 115 psi, and shall have manual flushing on/off control. Filter element shall be molded polyester screen cylinder with minimum 120 mesh screen.
- H. Preset pressure regulators shall be as manufactured by RainBird Inc. Model PSI-HMB for above or below ground application with 80psi max. Inlet pressure and 25 psi outlet pressure between 120 and 1320 gph.

PART 3 - EXECUTION

3.1 INSPECTION OF EXISTING SITE CONDITIONS

- A. Before any work begins, a conference shall be held with the Owner's authorized representative and the Contractor regarding general requirements for the project.
- B. It is the responsibility of the Contractor to familiarize himself with future locations of walls, paving, grade differences, etc. He shall coordinate his work with the General Contractor and other SubContractors for the location and installation of pipe sleeves through walls, footings, under paving, etc., and so that there is no difficulty in the subsequent planting of trees or shrubs which are shown in the plans.

- C. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities that are caused by his operation or neglect. Check existing utilities Drawings for existing utility locations. Before excavating, call Underground Service Alert, (800) 422-4133
- D. Contractor shall not willfully install the sprinkler system as shown on the Drawings when it is obvious in the field that obstructions, grade differences, or differences in dimensions of areas exist that might not have been considered in the engineering.
 - 1. Such obstructions or differences shall be brought to the attention of the Owner's authorized representative.
 - 2. In the event this notification is not performed, the Contractor shall assume full responsibility for any revisions necessary.
- E. Contractor shall carefully check all grades to satisfy for himself that he may safely proceed before starting work on the sprinkler irrigation system.

3.2 PREPARATION

- A. Physical Layout: Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads. All layouts shall be approved by Architect prior to installation.

3.3 WATER SUPPLY

- A. The Contractor shall verify static pressure on site prior to commencement of any work.
- B. The system design is based upon the minimum operating pressure and maximum flow demand shown on the Drawings.
 - 1. Contractor shall report any difference between the water pressure shown on the Drawings and the actual pressure at the point of connection to the Owner's authorized representative.
- C. All work required for proper point of connection and laying of irrigation supply line shall be in accordance with all applicable codes and ordinances.
- D. Connections shall be made at approximate locations as shown on Drawings. Contractor is responsible for minor changes caused by actual site conditions.
- E. Where connections are made between new work and existing water mains, the connections shall be made by using special couplings, Rockwell Clamp and Coupling-Tapping Sleeves, or equal, and other fittings to suit the on-site conditions.
 - 1. Methods of connections to existing mains shall be as required by local codes.
 - 2. All connections shall be constructed with approved materials and installation methods that meet or exceed individual public utility agency standards.

3.4 INSTALLATION

- A. Trenching
 - 1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to even grade. Trenching excavation shall follow layout indicated on Drawings and as noted.

2. Provide for a minimum of 18" cover for all pressure supply lines.
3. Provide for a minimum cover of 12" for all non-pressure lines.
4. Where it is necessary to excavate adjacent to existing trees, Contractor shall use all possible care to avoid injury to trees and tree roots.
 - a. Excavation in areas where two-inch and larger roots occur shall be done by hand.
 - 1) All roots two inches and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying.
 - b. Where a ditching machine is run close to trees having roots smaller than two inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through.
 - c. Roots one inch and larger in diameter shall be painted with two coats of Tree Seal or equivalent.
 - d. Trenches adjacent to trees should be closed within 24 hours, and where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.
5. Provide for a minimum cover of 18" for all control wiring.

B. Backfilling - General

1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equivalent to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than 1/2" in size will be permitted in the initial backfill.
3. Flooding of trenches will be permitted only with approval of the Architect.
4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawns, planting, paving or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching and Backfill Under Paving

1. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand (a layer three inches below the pipe and three inches above the pipe) and compacted to 90% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
2. Generally, piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Architect. No hydraulic driving will be permitted under concrete paving.
3. Provide for a minimum cover of 24" between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies

1. Routing of sprinkler irrigation lines as indicated on the Drawings is diagrammatic. Install lines and various assemblies to conform to the details shown on Drawings.
 2. Perform all directional changes using 45-degree elbows. No 90-degree elbows will be permitted without approval of Architect.
 3. Install all assemblies in accordance with respective detail. In absence of detail Drawings or Specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with prior approval of Architect.
 4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent-welding methods shall be as recommended by the pipe and fitting manufacturer.
 5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equivalent shall be used on all threaded PVC-to-PVC joints, and on all threaded PVC-to-metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.
- E. Line Clearance: All lines shall have a minimum clearance of six inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.
- F. Automatic Controller
1. Install as per manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence shown on the Drawings.
- G. Control Wiring
1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
 - a. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
 - b. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.
 2. An expansion curl shall be provided within three feet of each wire connection.
 - a. The expansion curl at each splice connection and at each electric control valve shall be long enough to bring the valve bonnet to the surface without disconnecting the control wires.
 3. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Architect, and if approved, shall be protected by a valve box type enclosure.
- H. Tracer Wiring
1. Place No. 12 gauge copper identification wire at bottom of trench for all mainline PVC pipe.
 - a. Use separate segment of wire between each pair of valves along the length of the mainline.
 - b. Wrap each end around the valve body, leaving at least a two foot length of wire free.
 - c. Neatly coil the excess two feet of wire and place in valve box.
- I. Remote Control Valves: Install where shown on Drawings and details.
1. When grouped together, allow at least 12" between valves. Install each control valve in a separate box. Use approved plastic valve box extensions to proper depth below pipeline.
 2. Locate valve boxes 12" from, and perpendicular to, adjacent paving.

J. Flushing of System

1. After all new sprinkler pipe lines and risers are in place and connected, and prior to installation of sprinkler heads, the control valves shall be opened and full head of water used to flush out the system.
2. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Architect.

K. Drip Irrigation installation

1. Install control valves and rigid PVC distribution lines prior to planting operations.
2. After container plants 1 gallon and larger are planted and grades are finished, install drip hoses and emitters. Bury drip tubing 4" deep unless specified differently in the plans and details.
3. Flush and adjust systems, eliminate leaks, operate for a one-hour period, then re-check and re-adjust systems.
4. Complete planting and mulching operations.

3.5 TEMPORARY REPAIRS

- A. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the builder/developer shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.6 FIELD QUALITY CONTROL

A. Adjustment of the System

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent over-spray onto walks, roadways, and buildings.
2. If it is determined that adjustment in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle size and degrees of arc as required.
3. When the radius of any sprinkler head requires downward adjustment to better suit actual conditions, the Contractor shall install pressure-compensating screens by the same manufacturer as the sprinkler nozzle, for flow and radius control.
4. The Contractor shall lower raised sprinkler heads within 10 days after notification by Owner.
5. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans.
6. It is the intent of the design to install pop-up heads adjacent to any pedestrian circulation. In the event of an area of pedestrian circulation does not have pop-up heads specified, it shall be the responsibility of the Contractor to bring this to the attention of the Architect or install the pop-up heads to match those specified.

B. Testing of Irrigation System

1. Test all pressure lines under hydrostatic pressure of 150 lbs./sq.in. and prove watertight. Note: testing of pressure main lines shall occur prior to installation of electric control valves.
2. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs./sq.in. and prove watertight prior to paving.
3. Sustain pressure in lines for not less than two hours. If leaks develop, replace and repeat test until entire system is proven watertight.

4. All hydrostatic tests shall be made only in the presence of the Architect or other duly authorized representative of the Owner. No pipe shall be backfilled until it has been inspected, tested and approved in writing.
5. Furnish necessary force pump and all other test equipment.
6. When the sprinkler irrigation system is completed, perform a coverage test to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage. This test shall be accomplished before any ground cover is planted or inspections are requested.
7. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.
8. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven days prior to any planting.
9. The Architect reserves the right to waive or shorten the operation period.

3.7 CLEAN-UP:

- A. Cleanup shall be made as each portion of work progresses.
 1. Refuse and excess dirt shall be removed from the site
 2. All walks and paving shall be swept or washed down.
 3. Any damage sustained on the work of others shall be repaired to original conditions acceptable to Owner and Architect.
- B. Cleanup shall be performed at the end of each working day, and a maximum cleanup effort shall be made for each weekend by the Contractor in a manner satisfactory to the Owner.

3.8 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. The Contractor shall operate each system in its entirety for the Architect at time of final observation. Any items deemed not acceptable shall be reworked to the complete satisfaction of the Architect.
- B. The Contractor shall show evidence to the Architect that the Owner has received all accessories, extra parts, charts, record Drawings, and equipment as required before final observation can occur.

3.9 OBSERVATION SCHEDULE

- A. Contractor shall be responsible for notifying the Architect in advance for the following observations according to the time indicated:
 1. Pre-job Conference - Seven days.
 2. Pressure supply line installation and testing - 48 hours.
 3. Automatic controller installation - 48 hours.
 4. Control wire installation - 48 hours.
 5. Lateral line and sprinkler installation - 48 hours.
 6. Coverage test -48 hours.
 7. Final observation - Seven days.
- B. When inspections have been conducted by other than the Architect, show evidence of when and by whom these inspections were made.

- C. No observation shall commence without adequate preparation or as-built Drawings. In the event the Contractor calls for an observation without as-built Drawings without completing previously noted corrections, or without preparing the system for observations, he shall be responsible for reimbursing the Architect at the hourly rate in effect at the time the observation portal-to-portal (plus transportation costs) for the inconvenience. No further inspections will be scheduled until this charge has been paid.

END OF SECTION 32 84 00

SECTION 32 90 00 – LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes materials, soil and installation in over-structure planters, soil preparation, planting, sodding, staking and cleanup.
 - 1. Planting occurs at street level and near building entry gate.
- B. Related work:
 - 1. Section 32 01 30: Operation and Maintenance of Site Improvements
 - 2. Section 32 84 00: Landscape Irrigation
- C. Definitions:
 - 1. Architect: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.
 - 2. Soil Test: Required testing performed by Contractor after site is rough graded. A current soil report is also required for import soil prior to transport to the site.
 - 3. Punch List: List of work within the Contract, generated by Architect that needs to be completed, repaired, replaced, or rectified by Contractor.
 - 4. Pre-maintenance review: Observation by Architect to verify substantial completion of the Work. The Architect will generate a Punch List during this review. Maintenance Period will commence when Contractor has completed items on this Punch List and Architect has verified that the Punch List is complete.
 - 5. Maintenance Period: See Specification section 32 01 90.
 - 6. Final Acceptance: Observation review by Architect at end of the specified Maintenance Period to verify completion and acceptance of the Work.

1.2 QUALITY ASSURANCE

- A. Standards:
 - 1. Provide plants and planting materials that meet or exceed specifications of Federal, State, and County laws requiring inspection for plant disease or insect control.
 - 2. Provide quality and size conforming to current edition of "Horticultural Standards" for number one nursery stock as adopted by the American Association of Nurserymen.
 - 3. Provide plants that are true to name. Tag one of each bundle or lot with the name and size of plants in accordance with the standards of practice of the American Association of Nurserymen.
 - 4. Botanical names shall take precedence over common names.
- B. Workmanship: Perform work in accordance with the best standards of practice for landscape work and under the continual supervision of a competent foreman capable of interpreting the Drawings and Specifications.
- C. Quantities and Types: Plant materials shall be furnished in the quantities and/or spacings as shown or noted for each location, and shall be of the species, kinds, sizes, etc., as symbolized and/or described in the Plant List, and as indicated on the Drawings.

- D. Verification of dimensions and quantities: scaled dimensions are approximate. Before proceeding with work, carefully check and verify dimensions and quantities and immediately inform the Architect of discrepancies between the Drawings and/or specifications and actual conditions. Do not start work in areas where there are discrepancies until approval for same has been given by the Architect.

1.3 SUBMITTALS

- A. Submit documentation to Architect 60 days before start of planting that plant material is available. Include:
1. A list of plants stating quantity, size, and supplier.
 - a. Requests for substitutions due to unavailability must be made in writing.
 - b. Substitutions may not be made without approval of the Architect.
 - c. Contractor shall notify Architect 24 hours in advance of delivery of plant materials, and shall submit an itemized list of plants in each delivery.
 2. Photographs of trees 24" box and larger.
 - a. Label each photo with plant name, plant height, spread and trunk caliper.
 - b. Label each photo with nursery name, nursery contact and phone number.
 - c. Photograph shall include a person in picture for scale purposes.
- B. Soil Test: Contractor shall have import soil and the soil of the site tested for fertility, agricultural suitability, percolation rate, organic matter, and appraisal to comply with AB1881 and MWEL0 requirements by Soil and Plant Laboratory Inc. (714) 282-8777, or Wallace Labs (310) 615-0116.
1. Submit a copy of the Planting Plan and Plant Legend to the laboratory with the samples.
 2. Soil Management Report shall include:
 - a. pH measurement.
 - b. Nutrients and elements:
 - 1) Measurement (low, medium, high) of: Boron, calcium, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, sodium, sulfur, and zinc.
 - 2) Analyze saturation extract for: calcium, magnesium, sodium, boron, chloride, phosphorus, nitrate and sulfate.
 - 3) Trace metals: Aluminum, arsenic, cadmium, chromium, cobalt, lead, lithium, nickel, selenium, silver, strontium, tin and vanadium.
 - 4) The presence of calcium carbonate and/or magnesium carbonate.
 - c. Soil Texture (gravel, sand, silt and clay). Determine organic matter content by the measurement of organic carbon. The quality of the organic matter shall be determined by measuring organic carbon and total nitrogen.
 - 1) Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods, Soil Science Society of America, Inc., 1986, chapter 36, pgs 901-926 and Methods of Soil Analysis, Part 3 Chemical Methods, Soil Science Society of America, Inc., 1996, chapter 34, pgs 965-977 & pgs 1001-2 and chapter 37, pg 1088
 - d. Interpretation and recommendations for correction of nutritional deficiencies/excesses and potential toxicities.
 3. Soil shall be tested from a minimum of four (4) locations per acre of planted area. Contractor shall record locations where samples were taken.
 4. A copy of the soil test results shall be submitted to the Owner and Architect before work begins.
 5. Contractor shall pay cost of soil tests.

- C. Cut sheets of materials to be used: tree stakes, tree guys, root barriers, amendments, mycorrhizal fungi, etc.
- D. Legible copies of delivery slips for soil amendments, including mycorrhizal fungi.
- E. The Contractor shall submit samples or specifications of items being used upon the request of the Architect, and as required by this Part 2 of this Specification.

1.4 OBSERVATION SCHEDULE

- A. Contractor shall be responsible for notifying the Architect, in advance, for the following observations, according to the time indicated:
 - 1. Pre-construction conference – seven (7) days
 - 2. Tree tagging at nursery (trees 24” box size and larger) – 48 hours
 - 3. Final grade, soil preparation and planting area layout review - 72 hours
 - 4. Plant materials review - 48 hours
 - 5. Plant layout review - 48 hours
 - 6. Planting operations - 48 hours
 - 7. Completed planting (Pre-maintenance) walk through – seven (7) days
- B. Contractor shall be responsible for scheduling site Observation visits with Architect as work progresses. Failure to schedule required Observations shall not relieve Contractor of responsibility for obtaining approvals. Contractor shall redo, at no cost to the Owner, work that does not satisfy the Owner.
- C. Observations may be waived or combined at the discretion of the Architect.
- D. When someone other than the Architect conducts Observations, the Contractor shall show evidence in writing of when and by whom these observations were made.
- E. No site visits shall commence without adequate preparation or items noted in previous Observation Reports, either completed or remedied, unless the Owner has waived such compliance. Failure to adequately prepare or accomplish previous punch list items shall make the Contractor responsible for reimbursing the Architect for the site visit at his current billing rates per hour plus transportation costs. No further inspections will be scheduled until this charge has been paid and received.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer or soil amendments to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and conformance to state law. Protect material from damage or breakage. Immediately remove empty containers from site.
- B. Deliver plants with legible identification labels. Store plant material in shade and protect from weather or injury. Maintain in a healthy, vigorous condition. Architect may at time reject plant material not maintained in this condition.
- C. Handling: Do not drop plants or pick up container plants by their stems or trunks.

1.6 SAMPLES AND TESTS:

- A. Contractor shall submit soil samples for testing, per this Specification.
- B. Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Architect.
- C. Rejected materials shall be immediately removed from the site at the Contractor's expense.
- D. Contractor shall pay cost of testing or replacement of materials not meeting specifications.

1.7 WARRANTY AND REPLACEMENT

- A. Contractor shall fully warrant and agree to replace poor, inadequate, or defective materials and workmanship for one year from date of acceptance of completed planting work.
- B. Palm trees: Guarantee newly planted palm trees for a period of two years following planting and acceptance by Owner.
- C. Replacement: Materials found to be dead, missing, or in poor condition during the establishment period shall be replaced immediately. The Architect shall be the sole judge as to the condition of material. Material to be replaced during the warranty period shall be replaced by the Contractor within fifteen days of written notification by Owner.

PART 2 - PRODUCTS

2.1 SOIL

- A. Site Soil:
 - 1. Site soil used to form landscape planting areas or backfill planters shall be clean, fertile, loamy soil, free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
 - 2. The Architect shall approve suitability of soil of the site after reviewing results of the soil test.
- B. Import Top Soil: Clean, fertile, sandy loam soil, free of stones or other deleterious matter one inch in diameter or larger. It shall also be free of pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens. Import top soil must conform to the following:
 - 1. Particle size

a.	Class	Particle Size	Maximum %	Minimum %
b.	Coarse sand	0.5 - 2.0mm	15	0
c.	Silt plus clay	<0.05mm	50	15
	Other classes:			
d.	Gravel	2-13mm	15	0
e.	Rock	1/2 - 1"	5% by volume with none > 1"	
 - 2. Chemistry
 - a. Salinity: Saturation Extract Conductivity (ECe) - less than 3.0 sD/m @ 25° C

- b. Sodium: Sodium Absorption Ratio (SAR) - less than 6.0
 - c. Boron: Saturation Extract Concentration - Less than 1.0 ppm
 - d. Reaction: pH of Saturated Paste - 5.5-7.8 without high lime content
3. Soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required material prior to planting.
4. In order to insure conformance, samples of the import soil shall be submitted to an approved laboratory for analysis prior to and following backfilling.
5. Obtain imported topsoil from approved local sources.
6. Compost
 - a. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. The organic matter content shall be at least 50% on a dry weight basis.
 - b. The pH of the material shall be between 6 and 7.5.
 - c. The salt content shall be less than 10 millimho/cm @ 25° C. (ECe less than 10) in a saturated paste extract.
 - d. Boron content of the saturated extract shall be less than 1.0 part per million.
 - e. Silicon content (acid-insoluble ash) shall be less than 50%.
 - f. Calcium carbonate shall not be present if to be applied on alkaline soils.
 - g. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
 - h. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
 - i. Sludge-based materials are not acceptable.
 - j. Carbon:nitrogen ratio is less than 25:1.
 - k. The compost shall be aerobic without malodorous presence of decomposition products.
 - l. The maximum particle size shall be 0.25 inch, 80% or more shall pass a 2 millimeter screen.
7. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

a. arsenic	20	copper	150	selenium	30
b. cadmium	15	lead	100	silver	10
c. chromium	100	mercury	10	vanadium	200
d. cobalt	50	molybdenum	20	zinc	200
e. nickel	100				
8. Apply nutrients as need to conform to the specified fertility.
9. Chemical properties of mix shall be as follows:
 - a. Organic matter – 4.0% to 7.0% on a dry weight basis, carbon:nitrogen ratio under 20
 - b. Ammonium bicarbonate available DTPA nutrients
 - c. Free limestone shall not be present
 - d. Sufficient fertility for vigorous plant growth.
 - e. See table:

Chemical Properties	Soil Specified Values	
pH in saturation extract	6.5 - 7.5	
salinity saturation extract	0.5-2.5	
Chloride saturation extract	< 150	
soluble boron saturation extract	< 1	
SAR in saturation extract	<3	
phosphorus	25-44	
potassium	125-250	
iron	10-150	
manganese	1-35	
zinc	2-10	
copper	0.5-5	
magnesium	75-150	
sodium	0-100	
sulfur	25-500	
aluminum	< 5	
molybdenum	0.2-2	
calcium carbonate	slight or none	
Heavy metals		
arsenic	<1	
cadmium	<1	
chromium	<2	
cobalt	<2	
lead	<40	
mercury	<1	
nickel	<5	
selenium	<1	
silver	<0.5	
vanadium	< 3	

- C. Units are mg/kg dry weight determined with Ammonium bicarbonate DTPA extraction
- D. Backfill for at grade trees and shrubs shall be per Soil Management Report.
- E. Backfill for over-structure planters: On-Structure Soil.

2.2 SOIL AMENDMENTS

- A. Soil amendments shall be as required by Soils Test.

- B. Contractor shall provide amendments recommended by Soils Report at no additional cost to Owner, including recommendations for the quality of organic amendment.
- C. Mycorrhizal fungi shall be added in all planting areas, regardless of Soils Report. Mycorrhizal inoculum consists of a combination of :
 - 1. Inoculum shall contain a blend of eight top types of Endospores: Glomus aggregatum, G. clarum, G. deserticola, G. intraradices, G. monosporus, G. mosseae, Gigaspora margarita, and Paraglomus brasilianum, and seven top types of Ecto fungi spores: Lacarria laccata, Pisolithus tinctorius, Rhizopogon amylpogon, R. fulvigleba, R. rubescens, R. villosuli, and Scleroderma spp. The guaranteed Endo spore count shall be a minimum 50 spores/cc, and the Ecto spore count shall be a minimum 50,000 spores/cc
 - 2. Manufacturers:
 - a. BioOrganics Mycorrhizae Inoculants, (888) 332-7676
 - b. Mycorrhizal Applications, Inc, (866) 476-7800
 - c. Or equal.

2.3 PLANT TABLETS

- A. 7 gram planting tablet designed for 12 month slow release. 12-8-8 NPK, 20% humus, 4% humic acids, 3.5% sulfur, 2% iron, micronutrients.

2.4 PLANT MATERIAL:

- A. Plants shall be in conformance with the California State Department of Agriculture's regulation for nursery inspections, rules, and ratings. Plants shall be healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, frostdamage, abrasions, or other disfigurement. Plants shall be grown in climatic conditions similar to that of the planting site, and well hardened off. Plants shall have vigorous fibrous root systems which are not rootbound or potbound. The Architect is the sole judge as to acceptability of plant material.
- B. The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified on Drawings.
- C. The Architect shall approve plant material prior to planting. Plants shall be subject to review and approval of Architect at place of growth or upon delivery for conformity to specifications, and for injury, insect infestation, and trees and shrubs for improper pruning. Such approval shall not impair the right of review and rejection during progress of the work. Architect reserves the right to refuse review if, in his/her judgment, a sufficient quantity of plants is not available for review.
- D. Plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site and replaced with new plants at the Contractor's expense.
- E. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book."
- F. Substitute plant material will not be permitted unless specifically approved in writing by the Architect.

2.5 GUYING AND STAKING MATERIALS:

- A. Wood tree stakes: Lodgepole pine, fully treated with CuNap, ACQ or other non-arsenic wood preservative. Do not use split stakes.
 - 1. 24" box trees and smaller: 2" (nom.) diameter by 10' long.
 - 2. 36" box trees: 3" (nom.) diameter by 12' long.
- B. Pipe tree stakes: Schedule 40 steel pipe, 1-1/2" diameter with cap, primed and painted before installation with two coats flat black exterior enamel. Touch up in field to match shop condition.
- C. Tree Ties:
 - 1. Flexible vinyl tree ties meeting ASTM-D-412 standards for tensile and elongation strength. Material shall be black.
 - 2. Each tie shall be a single piece, not multiple ties joined together.
 - 3. Manufacturers: VIT Cinch Tie, VIT Cinch Belt (larger trees), Villa Root Barrier E-Z Band, or equal.

2.6 WATER:

- A. Furnished by Owner.
- B. Transport by Contractor as required.

2.7 MULCH:

- A. Decorative Bark:
 - 1. Walk-On-Bark as supplied by Sequoia Forest Products, telephone: (559) 591-1177.
 - 2. Small Bark product #083 by Kellogg Supply, Inc., telephone: (310) 830-2200.
 - 3. Small Deco Bark by Aguinaga Fertilizer Company, (949) 786-9558.
- B. Composted, shredded tree trimmings:
 - 1. Forest Floor 0-2" by Aguinaga Fertilizer Company, (949) 786-9558.
- C. Submit mulch samples for approval by Architect. No shredded lumber products will be accepted.

2.8 METAL EDGING:

- A. Steel edging shall be 3/16" x 5 1/2", black color, with 18" steel stake.
 - 1. Manufacturer: Sure-Loc. (800) 787-3562.

2.9 DRAINAGE MATERIAL

- A. 3/8" crushed rock:
 - 1. 95% -100% passing through a 3/8" screen.
 - 2. 0-5% passing through No. 8 mesh.
 - 3. 80-100# per cubic yard.

2.10 SOIL SEPARATOR:

- A. Nonwoven polypropylene fabric, needle-punched, with UV Resistance of 70%, AOS of 70 US Standard sieve, water flow rate of 110 gpm/ft².
 - 1. Geotex 701, manufactured by Propex, or equal.

2.11 EROSION CONTROL FABRICS

- A. Jute mesh.
 - 1.

Specification	Test Method	Typical Values
a. Yarn Fiber: Woven jute, undyed and unbleached		
b. Yarn Count, Warp: 78 per width, minimum		
c. Yarn Count, Weft: 42 per linear yard, minimum		
d. Color: Natural(Brown, Earth Tone)		
e. Fabric Width (in): 48		
f. Fabric Weight (lb/yd ²): 92		
g. Strands/ft, Warp: 19.5		
h. Strands/ft, Weft: 14.0		
i. Mass/Unit Area (oz/yd ²): 14.7		
j. Wide Width Tensile, Dry (lb/ft)		
Warp x Fill	ASTM D 4595	300 x 175
k. Wide Width Tensile, Wet (lb/ft)		
Warp x Fill	ASTM D 4595	125 x 65
l. Elongation at Break (%): 10 x 10		
m. Open Area (%): 60 - 65		
n. Durability(yr): 1 - 2		
o. Water Velocity (ft/sec): 8		
p. Unit Shear Test (lb/ft ²): 0.45		
q. "C" Factor, 1.5:1 slope, 0.005		

2.12 WEED CONTROL FABRIC

- A. Spun-bonded polypropylene with UV inhibitors, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gasses and fertilizer. Typar 3301 or equal.
- B. Properties:
 - 1. Unit Weight: 3.0 oz/yds²
 - 2. Tensile Strength: 135 pounds
 - 3. Puncture Strength: 35 pounds
 - 4. Air Opening Size: 60/70 equivalent sieve
 - 5. Elongation at Break: <70%
 - 6. Trap Tear: 50 pounds
 - 7. Flux: 70 gal/ft²/min
 - 8. Permittivity: 1.2 sec-2
 - 9. Color: Black

2.13 ROOT BARRIER

- A. Polyethylene (0.08 inch thick) or polypropylene (2.032 - 2.16 mm thick), with self-locking joiners, ½" raised 90 degree molded root deflecting ribs, ground lock tabs, double top edge, UV inhibitors. Use 24" barrier unless otherwise stated.

- B. Bamboo root barrier: 0.76mm thick, minimum, polyethylene. Use 36" wide barrier unless otherwise stated.

2.14 DRAIN PIPE:

- A. Sub-Surface perforated or non-perforated as indicated on Plans, size and type noted, manufactured by Lasco, National Diversified Sales (NDS) or Advanced Drainage Systems, Inc. Perforated pipe shall be completely wrapped with a water permeable nylon screen that is lapped and welded around the pipe, and surrounded by minimum 4" thickness of gravel, unless otherwise noted on Plans.
- B. Planter Area Drainpipe and Fixtures: National Diversified Sales (NDS) SDR 35 fittings and SDR 35 drain pipes with specified grates, color black, and size and type per plan. NDS, Newbury Park, California, telephone: (800) 726-1994.

2.15 SIPHON DEVICE / DRAIN CLEANOUT

- A. Construct PVC assemblies per drawings.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

- A. Site acceptance:
 - 1. The Contractor shall be responsible for coordinating his work with the General Contractor and other Sub-Contractors so no damage occurs to plantings after installation.
 - 2. The Contractor shall be responsible for verifying grades and site conditions before beginning work. No change in Contract price will be owed for actual or claimed discrepancy between existing grade and those shown on the plan after Contractor has accepted existing grades and moved on the site.
- B. Scheduling: Perform planting only when weather and soil conditions are suitable, as approved by Architect.
- C. The irrigation system shall be operational and approved prior to planting.
- D. Utilities: Prior to excavation for planting or installation of stakes or guys, Contractor shall locate utility lines and cables, so that proper precautions will be taken not to damage them. In the event of a conflict between utility lines and plant locations, promptly notify the Architect, who shall arrange for the relocation of one or the other. Failure to follow this procedure shall make the Contractor responsible for repairing damages at his own expense.
- E. Waterproofing: Verify that waterproofing is complete and water-tight in over-structure planters.

3.2 SOIL PREPARATION:

- A. Planting Areas:
 - 1. Uniformly spread amendments and thoroughly cultivate by means of mechanical tiller per Soils Report.

2. Use nutrients recommended in the Soil Report.
 3. Add the appropriate Mycorrhizal inoculum and incorporate at manufacturer's recommended rate.
 4. Perform soil preparation after irrigation is installed and tested, and prior to planting.
- B. Final Grades and Planting Area Layout:
1. At time of planting, the top two (2) inches of areas to be planted or seeded shall be free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
 2. Contractor shall be responsible for shaping planting areas as indicated on Plans or as directed by Architect.
 3. Minor modifications to grade may be required to establish the final grade. Remove soil generated by excavations to an approved off-site location unless said soil can be utilized to obtain desired grade.
 4. Finish grading shall insure proper drainage of the site as determined by the Architect.
 5. Areas shall be graded so that the final grades will be 1-1/2" below adjacent paved areas, sidewalks, valve boxes, headers, cleanouts, drains, manholes, etc. or as indicated on Plans.
 6. Surface drainage shall be away from building foundations.
 7. Eliminate erosion scars prior to commencing maintenance period. Depressions due to settling shall be eliminated before and after planting.
 8. Slopes of two to one (2:1) or steeper shall be protected with erosion control fabric. Contractor shall request clarification from Architect for fabric and methods.
- C. Compacted Soil / Percolation Testing: Soil may be heavily compacted which can hinder root development, drainage and aeration.
1. Severely compacted areas shall be ripped or tilled to a depth of at least 9" prior to planting.
 2. Percolation tests of water through the soil shall be performed where trees 24" box size and larger are proposed. If trees are to be planted over a large area, several percolation tests will be required.
 - a. Excavate two planting pits 24" deep by 2 times rootball diameter. Install sand filled drainage sump as specified in 3.3.D.4, below, in one of the pits.
 - b. Fill the pits with water and allow to drain completely.
 - c. Fill the pits with water a second time.
 - d. Results:
 - 1) If the pit with no sump drains completely within 24 hours, no drain sump is necessary for trees planted within the vicinity of the test pit.
 - 2) If the pit with no sump does not drain completely within 24 hours, but the pit with the sump does, sumps are required for trees planted in the vicinity of the test pit.
 - 3) If the pit with the sump does not drain completely within 24 hours, advise the Owner prior to planting.
- D. Pre-Plant weed Control:
1. "Grow & Kill": If weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator. Leave sprayed plants intact to allow systemic kill as directed by Advisor. After recommended kill

- period, water thoroughly to encourage new weed growth, and re-apply systemic herbicide.
 2. Treat planting areas, except for those to be seeded, with pre-emergent herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator
 3. Maintain site weed free until final acceptance by Owner by utilizing mechanical, manual, or chemical treatment.
- E. Slope Stabilization
1. Slopes greater than 3:1 are to be stabilized with jute mesh.
 2. Prepare soil as noted above.
 3. Unroll jute from top of slope to bottom. Secure at top of slope by toeing jute in 6" deep. Reinforce with a row of at least five staples, spacing each about a foot apart, and covering with soil.
 4. Place staples 18" to 24" apart throughout to secure matting to ground. Staples must be driven flush with soil surface.
 5. Overlap edges of rolls 6", minimum. Securely staple the two layers to the ground.
 6. Install jute mesh loosely - do not stretch.
 7. Check slots may be needed on steep slopes to prevent subsurface erosion.
 - a. Dig 6" deep trench perpendicular to water flow.
 - b. Drop two or three folds of fabric in the slot.
 - c. Staple fabric securely in bottom of trench, and continue rolling down hill.
 8. Use approximately 200 staples per 100 square yards of fabric.

3.3 PLANTING

- A. Planting Layout: Plant layout is to be approved by Architect before planting begins. Layout of trees and major plantings shall be approved first. One tree with each type of specified staking shall be approved prior to planting of trees. Bring conflicts regarding the exact locations of plant pits to the attention of Owner's representative and Architect. If underground utility lines or other unknowns are encountered in excavation for planting, alternate locations for planting may be selected by the Architect. It is the Contractor's responsibility to verify with the Owner's superintendent and governing agencies the location and depth of underground utilities.
- B. Planting of Trees and Shrubs (at grade):
1. Do not plant rootbound, dried out, undersized, or damaged plants.
 2. Install trees, shrubs, and groundcovers before planting seed or sod.
 3. Excavated holes shall have vertical sides with roughened surfaces and shall be twice the diameter and the depth of the root b.
 4. Drainage: Drainage sumps are to be provided in each tree pit. Drain sumps (12-inch diameter by 6 feet deep) may be augured. Sump is to be filled with coarse sand. Planting may proceed after sump installation.
 5. Fill excavations with water and allow to percolate out, before positioning trees and shrubs.
 6. Install root control barriers where indicated on Plans and where site conditions (trees within three feet of pavement) dictate. Install per manufacturer's instructions.
 7. Center plant in pit or trench. Remove boxes and cans without damage to rootball. Add the appropriate Mycorrhizal inoculum next to rootball at manufacturer's recommended rate. Set plant plumb and hold rigidly in position until soil has been dampened firmly around b or roots. An earthen basin shall be constructed around each plant. Each basin

shall be of a depth sufficient to hold at least two inches (2") of water. Remove basin in turf areas after initial watering. Plants that settle deeper than the surrounding grade shall be raised to surrounding grade level.

- C. Planting Tablets: Place the following numbers of 7-gram planting tablets within the backfill of each plant:

Container size / Number of tablets

1 gallon	3
5 gallon	8
15 gallon	12
24" box	16
36" box	24
48" box	32

- D. Staking: Staking of trees shall be completed immediately upon planting. Stakes shall be installed plumb and as indicated in details. Guy locations and methods shall be reviewed prior to planting of boxed trees. Bring conflicts of locating guys or stakes to the attention of Architect. Remove nursery stakes when site stakes have been installed.
- E. Ground covers: Ground covers or seedlings shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawing. Triangular spacing shall be used unless otherwise noted on the drawing. Fill in bare areas with plants at the required spacing. Damage to plants by trampling or other work in this contract shall be repaired immediately.
- F. Mulch covers:
1. Complete planting and finish grades before placing mulch.
 2. Place mulch material in a continuous layer 3" deep adjacent to plant crown in shrub and groundcover areas, and in areas between shrubs.
 3. Place mulch in a 2" deep layer in areas with flatted groundcover and annual color.
 4. Install special mulches (glass, rock) over weed control fabric.
 - a. Overlap fabric a minimum of 8".
- G. Install Arbor-gard tree trunk protector on trees planted in turf areas. Install per manufacturer's instructions.

3.4 CLEANUP

- A. After planting operations have been completed, remove trash, excess soil, empty plant containers, and rubbish from the property, and dispose of legally.
- B. Cleanup shall be performed at the end of each working day, with a maximum cleanup effort (in a manner satisfactory to the Owner) for each weekend or Holiday.
- C. The Contractor shall sweep the site and shall wash down pavement within the Contract area, leaving the premises in a clean condition.
- D. Walks shall be left in a clean and safe condition.
- E. Scars, ruts, or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

END OF SECTION 32 90 00

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Roadway and/or site storm drainage system up to five feet of any on-site building

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. AASHTO
 - 1. M199: Precast Reinforced Concrete Manhole Sections
 - 2. M252: Corrugated Polyethylene Drainage Pipe
 - 3. M294: Corrugated Polyethylene Pipe, 12 to 604 inch Diameter
- B. ASTM
 - 1. A74: Cast Iron Soil Pipe and Fittings
 - 2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 5. C478: Circular Precast Reinforced Concrete Manhole Sections
 - 6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 8. C1173: Flexible Transition Couplings for Underground Piping Systems
 - 9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
 - 11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
 - 12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 13. D4101: Propylene Injection and Extrusion Materials
 - 14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 - 17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- C. AWWA
 - 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 - 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems

3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
 7. C150: Thickness design of Ductile Iron Pipe
 8. C151: Ductile-Iron Pipe, Centrifugally Cast
 9. C153: Ductile-Iron Compact Fittings
 10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
 11. M41: Ductile Iron Pipe and Fittings
- D. Caltrans Standard Specifications, 2015
1. Section 51, Concrete Structures
 2. Section 52, Reinforcement
 3. Section 65, Concrete Pipe
 4. Section 66, Corrugated Metal Pipe
 5. Section 70, Miscellaneous Drainage Facilities
 6. Section 72, Slope Protection
 7. Section 75, Miscellaneous Metal
 8. Section 90, Concrete
- E. Caltrans Standard Plans, 2015
1. Plan D94A: Metal and Plastic Flared End Sections
 2. Plan D94B: Concrete Flared End Sections
 3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection
 4. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers
 5. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands
 6. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint
 7. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint
 8. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Downdrain
 9. Plan D98A: Slotted Corrugated Steel Pipe Drain Details
 10. Plan D98B: Slotted Corrugated Steel Pipe Drain Details

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Water Works Association
- D. CMP: Corrugated metal pipe
- E. DIP: Ductile iron pipe

- F. HDPE: High-density polyethylene
- G. NPS: Nominal pipe size
- H. PE: Polyethylene
- I. PVC: Polyvinyl Chloride
- J. RCP: Reinforced concrete pipe

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
 - 1. Piping materials and fittings
 - 2. Special pipe couplings
 - 3. Polymer-concrete, channel drainage systems (trench drains)
 - 4. Joint sealants
 - 5. Plastic area drains
 - 6. Cleanout plugs or caps
 - 7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
 - 8. Precast clean out boxes and box covers
 - 9. Concrete, metal and plastic flared end sections
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
 - 1. Precast concrete manholes, frames and covers
- D. Design Mix Reports and Calculations: For each class of cast in place concrete
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
 - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling

1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 CORRUGATED METAL PIPE AND FITTINGS:

- A. CMP pipe shall be in accordance to Caltrans Standard Specification Section 66
- B. Bituminous Coating: Caltrans Standard Specification Section 66-1.02C
- C. Bituminous Lining: Caltrans Standard Specification Section 66-1.02C
- D. Bituminous Paving: Caltrans Standard Specification Section 66-1.02C
- E. Corrugated Aluminum Pipe: Caltrans Standard Specification Section 66-1.02F
- F. Corrugated Steel Pipe: Caltrans Standard Specification Section 66-1.02E
- G. Slotted Corrugated Steel Pipe: Caltrans Standard Specification Section 66-2
- H. Details: Caltrans Standard Plans D97A, D97C, D97D, D97E, D97F, D97G, D98A and D98B

2.2 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

- A. Pipe shall be in accordance to ASTM D1785, Schedule 40. [Check external load and laying condition, schedule 80 and 120 are also available if stronger pipe is required.]
- B. Joints: Solvent Cement, ASTM D2564
- C. Include primer according to ASTM F656
- D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.3 PVC PIPE, 4 INCH AND LARGER

- A. Pipe
 1. 4 inch through 15 inch: ASTM D3034, SDR 35
 2. 18 inch through 36 inch: ASTM F679, T-1 wall
- B. Bell and spigot joints

- C. Fittings:
 - 1. 4 inch through 27 inch: ASTM F1336
 - 2. 30 inch through 36 inch: ASTM D3034, SDR 35
- D. Joint Gasket: Elastomeric seal, ASTM F477
- E. Special Pipe Coupling: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.4 REINFORCED CONCRETE PIPE

- A. Designated by Class, rubber gasketed joints, Type II or V cement
 - 1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02C(2). Class III
- B. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F
- C. Special Pipe Couplings: Portland cement collar as indicated

2.5 PIPE ANCHORS

- A. General: Location, configuration bearing area, etc. as indicated
- B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.6 PIPE CLEANOUTS

- A. Piping: Same as storm drain line if possible
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap
- D. Box Types
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
 - 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading
- E. Box Cover Markings: "S.D.," unless otherwise specified
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
 - 1. Associated Concrete Products, Inc.
 - 2. Brooks Products Inc.

3. OldCastle Precast/Christy Concrete Products, Inc.

2.7 AREA DRAINS

- A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.
- B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.8 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).
- E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.02.B and 75-2
 - 1. Galvanize steel frames, grates and covers
 - 2. Grates and covers shall be non-rocking
 - 3. Rate for AASHTO H20 loading in traffic areas

2.9 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.
- B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.
- C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words "STORM

DRAIN” in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as herein specified. The concrete shall be Class “A” containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.
- G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or approved equal.

2.10 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

- A. Mortar: Caltrans Standard Specification Section 51-1.02F
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket
 - 1. Rubber Gaskets: ASTM C443
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by Henry Company, or approved equal.

2.11 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to precast and/or cast-in-place concrete structures.
 - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.

2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.12 POLYMER-CONCRETE TRENCH DRAINS

- A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.
- B. Include the following components:
 1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
- C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. "Polydrain" by ABT Inc.
 2. "ACO Drain" by ACO Polymer Products Inc. , or approved equal

2.13 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

- A. General: Caltrans Standard Specification Section 70-5.02 and Caltrans Standard Plan D94A and D94B

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

- C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturers' instructions

3.3 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
 - 1. Seal all joints and pipe entrances and exits.
 - 2. Place concrete in bottom and shape to convey flows as indicated.

3.4 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Install: As indicated and in accordance with the manufacturer's instructions.

3.5 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.
- B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
- D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.6 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.7 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.
- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
 - 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.

- a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
 - b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
 3. Pull-Through Device:
 - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- E. Deflection measuring Device:
1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
 2. Obtain approval of deflection measuring device prior to use.
- F. Deflection Measuring Device Procedure:
1. Measure deflections through each run of installed pipe.
 2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
 3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.
- G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.8 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.9 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the City for review.
- B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
 - 1. Low spot (1 inch or greater - mainlines only)
 - 2. Joint separations (3/4 inch or greater opening between pipe sections)
 - 3. Cocked joints present in straight runs or on the wrong side of pipe curves.
 - 4. Chips in pipe ends
 - 5. Cracked or damaged pipe
 - 6. Dropped joints
 - 7. Infiltration
 - 8. Debris or other foreign objects
 - 9. Other obvious deficiencies
 - 10. Irregular condition without logical explanation

END OF SECTION

EXHIBIT B

Teen Center, Plaza, and Skatepark Plans