

INVITATION FOR BIDS



FOR CONSTRUCTING

FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

CONTRACT NUMBER
C02336

ISSUED BY
CAPITAL PROJECTS ENGINEERING DIVISION
CITY OF SANTA ROSA, CALIFORNIA

2023

ATTENTION
Prebid Conference
See Page 1



STATE OF CALIFORNIA

INVITATION FOR BIDS

CONTAINING:

NOTICE TO BIDDERS

SPECIAL PROVISIONS

BID FORMS

CONTRACT

FOR

FINLEY AQUATIC CENTER SPRAY GROUND AND
RENOVATION PROJECT

Contract No. C02336

FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

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CITY OF SANTA ROSA
STATE OF CALIFORNIA

NOTICE TO BIDDERS

➤	For technical questions regarding this project, contact Dezire Perez-Barbante at (707) 543-4203.
➤	For direct access to plans, specifications and planholders' lists, go to www.srcity.org/bids and click on <u>Bid/Proposal Opportunities</u> or call (707) 543-3800.
➤	For direct access to bid results, go to www.srcity.org/bids . Under Link to Capital Projects, click on <u>Capital Projects Contracts</u> .

- IMPORTANT -
REVISED BIDDING PROCEDURES

All bids shall be submitted and opened according to the following procedure:

Bid Acceptance Deadline

Sealed bids will be accepted at the Transportation and Public Works Department, 69 Stony Circle, Santa Rosa, California 95401 until 2:00 p.m., July 25, 2023, for Finley Aquatic Center Spray Ground and Renovation Project, Contract No. C02336. (Engineer's Estimate: \$2,950,000).

Bids tendered after this deadline will not be accepted. The official time clock for accepting bids will be an electric date and time stamping clock, located in the Transportation and Public Works Department, 69 Stony Circle, Santa Rosa, California. In order to be accepted, bids must be received prior to 2:00 p.m. Therefore, a bid stamped in at 1:59 p.m. will be accepted, but one delivered at or after 2:00 p.m. is late and will not be accepted.

Bid Opening

Prospective bidders, subcontractors, and materials suppliers are invited to attend the Bid opening via Zoom video/teleconference or in person at 69 Stony Circle, Santa Rosa, California. The bid opening is scheduled to be held at 2:00 p.m. on July 25, 2023.

The teleconference can be accessed at:

<https://srcity-org.zoom.us/j/87535657886?pwd=eWhYaE9jcWNUdWRaalBsakxrUFNHZz09>

Phone: 1 669 219 2599

Meeting ID: 875 3565 7886

Passcode: 284277

Find your local number: <https://srcity-org.zoom.us/u/kcgTEHXsBU>

Project Description/Scope of Work

A major upgrade to Finley Aquatic Center including the demolition of the existing wading pool and construction of a new, modern spray ground, new and expanded picnic areas, and upgrades to the pool deck to replace areas in disrepair to ensure compliance with the Americans with Disabilities Act (ADA).

Mandatory Pre-Bid Meeting

Prospective bidders are required to attend a mandatory pre-bid meeting scheduled to be held at 10:30 a.m., July 13, 2023, at Finley Aquatic Center, 2060 W. College Ave., Santa Rosa. The first 15 minutes of the meeting will be held in front of the Finley Aquatic Center entrance. City staff will be taking attendance in writing and collecting questions from attendees. Please contact Dezire Perez-Barbante at (707) 543-4203 if you have any issues finding the location. After 10:45 a.m., if there are no calls received, the Pre-bid roster will be closed.

Subcontractor Information; Department of Industrial Relations Registration

Bidders shall provide the names, business addresses and license numbers of all subcontractors listed on bidder's List of Subcontractors. No contractor or subcontractor may be listed on a bid for this public works project unless registered with the Department of Industrial Relations (DIR) pursuant to Labor Code section 1725.5. No contractor or subcontractor may be awarded a contract for this public works project unless registered with the DIR pursuant to Labor Code section 1725.5. This public works project is subject to compliance monitoring and enforcement by the DIR.

Contract #: C02336

Project Title: FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

Line #	Description	Unit	Quantity
1	Finley Aquatic Center Spray Ground and Renovation Project	LS	1

The foregoing quantities are approximate only, being given as a basis for the comparison of bids, and the City of Santa Rosa does not expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, as may be deemed necessary or expedient by the Engineer.

Bids shall be made in accordance with the prevailing hourly rate of per diem wages for this locality and project as determined by the Director of the DIR pursuant to Labor Code sections 1770 *et seq.*

Contractor shall be responsible for compliance with the Immigration Reform Control Act of 1986.

If the project requires the employment of workers in any apprenticeable craft or trade, once awarded, Contractor and subcontractors must apply to the Joint Apprenticeship Council unless already covered by local apprentice standards (see Labor Code section 1777.5).

All bids are to be compared on the basis of the Engineer's estimate of the quantities of work to be performed. No bid will be awarded to a contractor who is not licensed in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code. Contractor must hold a Class A license for this project.

Project plans, bid and contract forms for C02336 Finley Aquatic Center Spray Ground and Renovation Project may be obtained through PlanetBids at www.srcity.org/bids. These documents can no longer be obtained at the Transportation and Public Works Department.

No bid will be accepted unless it is made on the contract bid forms furnished by the Transportation and Public Works Department through PlanetBids. The original of the completed bid forms bearing original signatures must be submitted. A bid will not be accepted unless the bidder registers as a vendor through PlanetBids at www.srcity.org/bids, downloads documents/attachments, and is added to the prospective bidders list for this project. If there is an addendum, bidders must log into PlanetBids and acknowledge the addendum to be eligible for bidding.

The successful bidder will be required to hold a current City of Santa Rosa business tax certificate issued pursuant to Chapter 6.04 of the Santa Rosa City Code before commencing work on this project. For information regarding the business tax, contact Revenue and Collections at (707) 543-3170.

For any moneys earned by Contractor and withheld by the City of Santa Rosa to ensure the performance of the Contract, Contractor may, at its request and expense, substitute securities equivalent to the amount withheld in the form and manner and subject to the conditions provided in Section 22300 of the California Public Contract Code.

The City of Santa Rosa reserves the right to reject any or all bids and the right to waive minor irregularities or informalities in any bid or bonds.

Lisa Welsh
Lisa Welsh (Jun 23, 2023 12:50 PDT)

LISA WELSH
Supervising Engineer

Jun 23, 2023

Date

SPECIAL PROVISIONS

General Specifications

CITY OF SANTA ROSA, CALIFORNIA

FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

1 GENERAL

The work described herein shall be done in accordance with the "Contract Documents," which are the:

1. Special Provisions
2. Project Plans, consisting of 68 sheets entitled Finley Aquatic Center Spray Ground and Renovation Project, 2022-014
3. City of Santa Rosa Design and Construction Standards (City Standards)
4. City of Santa Rosa Construction Specifications for Public Improvements (City Specifications)
5. State of California Department of Transportation Standard Specifications 2010 (Standard Specifications), and
6. State of California Department of Transportation Standard Plans 2010 (Standard Plans).

In the event of a conflict in any of these documents, the order of precedence shall be determined by Section 5-1.02 of these Special Provisions.

Whenever the Standard Specifications use the terms State of California, Department of Transportation, Director, Engineer, or Laboratory, the following terms shall be substituted therefor, and any reference to any of the foregoing terms shall be understood and interpreted to mean and refer to such substituted terms as follows:

For State of California - the City of Santa Rosa;

For Department - the City of Santa Rosa Department of Transportation and Public Works or the City of Santa Rosa Water Department;

For Director - the City Engineer of the City of Santa Rosa;

For Engineer - the City Engineer of the City of Santa Rosa or the City Engineer's authorized agents;

For Laboratory – Materials Engineering of the City of Santa Rosa Transportation and Public Works Department, or such other laboratory as may be authorized by the City.

Unless otherwise provided, whenever in these Special Provisions attention is directed to specific provisions in the Standard Specifications, such direction shall not be interpreted as excluding other applicable provisions of the Standard Specifications.

Unless otherwise provided, when sections and subsections of the Standard Specifications are used in these Special Provisions, such use is not exclusive and shall not be interpreted as excluding other applicable provisions of said sections and subsections but is only intended to add to or modify such sections or subsections.

Unless otherwise provided, full compensation for compliance with these Special Provisions is included in the contract price and no additional allowance will be made to Contractor therefor.

The Standard Specifications are hereby modified to delete any reference or incorporation of provisions providing for or requiring arbitration of any and all claims and disputes arising under this contract.

2 BIDDING

2-1.06 Bid Documents: Prospective bidders will be furnished with an Invitation for Bids which will state the location and description of the contemplated public works project and will show the approximate estimate of the various quantities and kinds of work to be performed and materials to be furnished with a schedule of items for which unit prices are requested.

2-1.07 Approximate Estimate: The quantities given in the Contract Documents are approximate only, being given as a basis for the comparison of bids, and the City does not, expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or part of the work or to omit parts of the work, as may be deemed necessary or advisable by the Engineer.

2-1.31 Examination of Project Plans, Specifications, City Standards, Invitation for Bids and Work Site: Prior to submitting a bid, the bidder shall carefully examine the Project Plans, Invitation for Bids, City Standards and the proposed work site. If any person contemplating submitting a bid for this public works project is in doubt as to the meaning of any part of the Contract Documents, or finds discrepancies in or omissions from the Contract Documents, he or she may submit a written request for interpretation or correction to the Engineer. The written request must be received by the Engineer a minimum of 96 hours prior to bid opening. Any interpretation or correction of the Contract Documents prior to bid opening will be made only by written addendum issued by the City. A copy of such addendum will be mailed or faxed to each Planholder. The City will not be bound by any other explanations or interpretations of the Contract Documents.

2-1.33 Bid Document Completion: Any references to Opt Out of Payment Adjustments for Price Index Fluctuations in the Standard Specifications are deleted in their entirety.

2-1.33A Bid Forms: All bids shall be made on bid forms obtained from PlanetBids at www.srcity.org/bids. The bidder shall submit its bid on the original bid forms furnished by the City. Bids submitted on forms other than the forms furnished to the bidder by the City will not be considered.

The bid forms to be submitted at the time of and with the bid are:

1. Unit Price Schedule
2. List of Subcontractors
3. List of Previous Similar Jobs
4. Noncollusion Declaration
5. Bid Guaranty Information and Bidder's Information and Signature
6. Bid Guaranty (Bid Bond or alternate security)

All bids shall give the proposed prices and must bear the original signature of the bidder. Bidders shall fill in all blanks on the bid forms where required. A bid will not be accepted unless the bidder registers as a vendor through PlanetBids at www.srcity.org/bids, downloads documents/attachments, and is added to the prospective bidders list for this project. If there is an addendum, bidders must log into PlanetBids and acknowledge the addendum to be eligible for bidding.

2-1.33B Registration with DIR: No contractor or subcontractor may be listed on a bid for this public works project unless registered with the Department of Industrial Relations (DIR) pursuant to Labor Code section 1725.5. No contractor or subcontractor may be awarded a contract for this public works project unless registered with the DIR pursuant to Labor Code section 1725.5. This public works project is subject to compliance monitoring and enforcement by the DIR.

2-1.33C Subcontractors: The Subletting and Subcontracting Fair Practices Act, Public Contract Code sections 4100-4113, inclusive (the "Act") shall apply to all subcontracts in excess of one-half of one percent of the total amount of a bid. The Act requires subcontractors, if used for such work, to be listed in the contractor's bid and prohibits the substitution of subcontractors, except as authorized by the Act. Each bidder shall, with respect to the work of any subcontractor in excess of one-half of one percent of the total amount of the bid, include as part of the bid on the bid form provided:

1. The name, business address and DIR registration number of each subcontractor who will perform work or labor or render services to the 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 Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the Project Plans or other Contract Documents in an amount in excess of one-half of one percent of the Contractor's total bid; and
2. The portion of the work that will be done by each subcontractor. Only one subcontractor shall be listed for each portion.

The purchase of sand, gravel, crushed rock, batched concrete, aggregate, ready-mixed concrete, and/or any other materials produced and furnished by established and recognized commercial plants, together with the delivery of such materials to the work site by the source of the materials or by recognized commercial hauling companies, is not considered as subcontracting under this section.

2-1.33E Rejection of Bids Containing Alterations, Erasures or Irregularities: Bids may be rejected if they show any alterations of forms, additions not called for, conditional bids, incomplete bids, erasures or irregularities of any kind.

2-1.34 Bid Guaranty: All bids shall be presented under sealed cover and shall be accompanied by cash, cashier's or certified check, or by a bidder's bond made payable to the City of Santa Rosa and executed as surety by a corporate surety authorized and admitted to transact a surety business in the State of California in an amount equal to ten percent of the amount of the bid. No bid shall be considered unless such cash, cashiers or certified check, or bidder's bond is enclosed with the bid. Any bidder's bond shall contain provisions for forfeiture consistent with California Public Contract Code section 20172.

2-1.40 Withdrawal of Bid: A bid may be withdrawn prior to, but not after, the hour fixed in the public notice for the opening of bids, provided that a written request to withdraw the bid, executed by the bidder or the bidder's authorized representative, is filed with the Engineer before this deadline. The withdrawal of a bid shall not prejudice the right of a bidder to submit a new bid.

2-1.43 Public Opening of Bids: Bids will be opened and read publicly at the time and place indicated in the Notice to Bidders. Bidders or their authorized agents are invited to be present.

2-1.46 Disqualification of Bidders: Serial bids from the same bidder will not be accepted. This section shall not be interpreted to mean that the same contractor may not be the contractor in one bid and listed as a subcontractor in another bid, provided that no collusion exists.

2-1.48 Competency of Bidders: No bid will be accepted from or contract awarded to a contractor that is not licensed in accordance with the law, that does not hold a license qualifying it to perform work under this contract, to whom a bid form has not been issued by the Engineer, or that has not successfully completed projects of similar character, scope and cost to the proposed project. Bidders will be required to provide a list of previous similar jobs with their bids.

3 CONTRACT AWARD AND EXECUTION

3-1.04 Contract Award: The City reserves the right to reject any or all bids. Bids are required for the entire work described herein. All bids will be compared with the Engineer's estimate of the quantities of work to be completed. Contract award, if any, will be made to the lowest responsible bidder within sixty days from the date bids are opened.

3-1.05 Contract Bonds: Within ten days after receipt of the Notice of Award, the successful bidder shall provide the following bonds to the City:

- a. **Performance Bond:** A performance bond to guarantee the faithful performance of the terms and conditions of the Contract by Contractor, which shall be executed in a sum of not less than one-half of the Contract price;
- b. **Labor and Materials Bond:** A labor and materials bond (payment bond) in accordance with Part 6 of Division 4, sections 8000 *et seq.* of the California Civil Code, to guarantee against any and all claims of subcontractors or other third parties furnishing labor, materials, or supplies for the Contract, which shall be executed in a sum of 100% of the Contract price; and
- c. **Material Guaranty Bond:** A material guaranty bond (warranty bond) to serve as surety for the guarantee requirements outlined in Section 6-3.01B, which shall be executed in a sum of not less than one-half of the Contract price.

The bond(s) shall be provided in a form acceptable to the City and issued by a corporate surety in good financial standing and authorized and admitted to transact a surety business in the state of California for the purposes and in the amount(s) stated above.

Whenever the financial or legal status of any surety on any such bond(s) is/are unacceptable to the City, it may make a demand to Contractor for further bond(s) or additional surety, not exceeding the sums originally required. Thereafter, no payment shall be made upon the Contract to Contractor or any assignees of Contractor until such bond(s) or additional surety has/have been provided to the City.

3-1.07 Indemnification and Insurance: **Indemnification:** Contractor shall defend, hold harmless and indemnify City, its officers, agents and employees, and each and every one of them, from and against any and all actions, damages, costs, liabilities, claims, demands, losses, judgments, penalties, costs and expenses of every type and description, including, but not limited to, any fees and/or costs reasonably incurred by City's staff attorneys or outside attorneys and any fees and expenses incurred in enforcing this provision (hereafter collectively referred to as "Liabilities"), including but not limited to Liabilities arising from personal injury or death; damage to personal, real or intellectual property or the environment; contractual or other economic damages, or regulatory penalties, arising out of or in any way connected with the performance of or the failure to perform the Contract by Contractor, any subcontractor or agent, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, whether or not such Liabilities are caused in part by a party indemnified hereunder, or such Liabilities are litigated, settled or reduced to judgment; provided, that the foregoing indemnity does not apply to liability for any damage or expense for death or bodily injury to persons or damage to property to the extent arising from (i) the sole negligence, or willful misconduct of, or defects in design furnished by City, its agents, servants, or independent contractors who are directly responsible to City (excluding Contractor), or (ii) the active negligence of City.

The existence of any of the insurance policies or coverages described in this Contract shall not affect or limit any of City's rights hereunder, nor shall the limits of such insurance limit Contractor's liability to the City hereunder. The provisions of this section shall survive any expiration or termination of the Contract.

Insurance: Contractor shall maintain in full force and effect all of the insurance coverage described in and in accordance with the insurance requirements set forth below. Maintenance of such insurance coverage during the entire performance of the Contract is a material element of the Contract. Failure by Contractor to (i) maintain or renew coverage, (ii) provide notice of any changes, modifications, or reductions in coverage, or (iii) provide evidence of renewal, if necessary, may be deemed a material breach of the Contract by Contractor, whereas the City shall be entitled to all rights and remedies at law or in equity. Notwithstanding the foregoing, any failure by Contractor to maintain required insurance coverage shall not excuse or alleviate Contractor from any of its other duties or obligations under the Contract. In the event Contractor retains or utilizes any subcontractors or sub-consultants in performance of the work, Contractor shall assure that any such subcontractor has first obtained, and shall maintain, all of the insurance coverage requirements herein set forth below.

Insurance Requirements:

A. Insurance Policies: Contractor shall maintain and keep in full force and effect, the following policies of insurance with minimum coverage as indicated below and issued by insurers with an AM Best rating of no less than A:VI or a rating otherwise acceptable to the City.

Insurance	Minimum Coverage Limits	Additional Coverage Requirements
1. Commercial general liability	\$5 million per occurrence \$5 million aggregate	Coverage must be at least as broad as ISO CG 00 01 and must include products liability and completed operations coverage which shall continue for a period of three years after acceptance of the work by the City. If insurance applies separately to a project/location, aggregate may be equal to per occurrence amount. Coverage may be met by a combination of primary and umbrella or excess insurance, but umbrella and excess shall provide coverage at least as broad as specified for underlying coverage. Completed Operations Coverage can be provided in the form of an endorsement to Contractor's insurance (at least as broad as ISO Form CG 20 37 04 13. See endorsements below for other Additional Insured Requirements. Coverage shall not exclude subsidence.
2. Business auto coverage	\$3 million	Coverage at least as broad as ISO Form Number CA 00 01 covering any auto (Code 1). Insurance shall cover owned, non-owned and hired autos.
3. Workers' compensation and Employer's Liability	\$1 million	As required by the State of California, with Statutory Limits and Employer's Liability Insurance with limit of no less than \$1 million per accident for bodily injury or disease. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the City for all work performed by Contractor, its employees, agents and subcontractors.
4. Course of construction/builders' risk	Amount of completed value of project without co-insurance provisions	Required for construction projects over \$3 million. The City shall be named as loss payee.

B. Endorsements:

1. All policies shall provide or be endorsed to provide that coverage shall not be canceled by either party, except after prior written notice has been provided to the City in accordance with the policy provisions.
2. Liability policies shall provide or be endorsed to provide the following:
 - a. For any claims related to this Contract, Contractor's insurance coverage shall be primary, and any insurance or self-insurance maintained by City shall be in excess of Contractor's insurance and shall not contribute with it. Endorsements at least as broad as 20 01 04 13 or evidence of policy language will be required in non-ISO CGL policies.
 - b. **The City of Santa Rosa, its officers, agents and employees are to be covered as additional insureds on the CGL policy.** Additional Insured Endorsements at least as broad as 20 10 04 13 or 20 38 04 13 are required.

C. Verification of Coverage and Certificates of Insurance: Contractor shall furnish City with original certificates and endorsements effecting coverage required above. Certificates and endorsements shall make reference to policy numbers. All certificates and endorsements are to be received and approved by the City before work commences and must be in effect for the duration of the Contract. The City reserves the right to require complete copies of all required policies and endorsements during the duration of the Contract and for a period of three years following City's acceptance of the work.

D. Other Insurance Provisions:

1. No policy required by this Contract shall prohibit Contractor from waiving any right of recovery prior to loss. Contractor hereby waives such right with regard to the indemnitees.
2. All insurance coverage amounts provided by Contractor and available or applicable to this Contract are intended to apply to the full extent of the policies. Nothing contained in this Contract limits the application of such insurance coverage. Coverage for an additional insured shall NOT be limited to the insured's vicarious liability. Defense costs must be paid in addition to coverage amounts.
3. Self-insured retentions above \$10,000 must be approved by the City. At the City's option, Contractor may be required to provide financial guarantees.
4. City reserves the right to modify these insurance requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other special circumstances.

3-1.18 Contract Execution: The fully executed Contract, original bonds and insurance certificates and endorsements required under the Contract shall be delivered to the City within ten calendar days of Contractor's receipt of the Notice of Award.

The Engineer will supply Contractor with up to ten sets of the Invitation for Bids and Project Plans. At least one complete set of the Invitation for Bids and Project Plans shall be kept at the construction site in good condition and made available to the Engineer at all times. Additional copies of the Invitation for Bids and Project Plans will be provided by the Engineer at Contractor's cost.

3-1.20 Failure to Execute Contract: Contractor's failure to deliver to the City the fully executed Contract within ten calendar days of Contractor's receipt of the Notice of Award shall be cause for the cancellation of the award and the forfeiture of the bid guaranty to the City. If the successful bidder refuses or fails to execute the Contract, the City may award the Contract to the second lowest responsible bidder. If the second lowest responsible bidder refuses or fails to execute the Contract, the City may award the Contract to the third lowest responsible bidder. The refusal or failure by the second or third lowest responsible bidder to deliver to the City the fully executed Contract within ten calendar days of receipt of the Notice of Award to the respective bidder shall

likewise be cause for the cancellation of the award and the forfeiture of the bid guaranty of the respective bidder. In its discretion, the City may then re-advertise the project or construct it by day labor.

3-1.21 Return of Bid Guarantees: Within ten days after the opening of bids, the City will return the bid guarantees to all bidders except the three lowest responsible bidders. The bid guarantees of the three lowest responsible bidders will be retained until the Contract has been fully executed. In the event all bids are rejected, all bid guarantees will be returned to the respective bidders.

3-1.22 Subcontractors: The successful bidder shall furnish a list of all subcontractors as required under Sections 2-1.33C. The list shall include the name, business address, DIR registration number and the state contractor's license number of each subcontractor on the list and the names of the responsible managing employees whose names appear on the subcontractors' licenses.

4 SCOPE OF WORK

4-1.05 Changes and Extra Work: All changes to the Contract shall be made by written change order only.

All extra work shall be recorded by Contractor on a daily report signed by both the City and Contractor. The “daily reports” shall thereafter be considered the true record of extra work performed. A copy of the daily reports will be furnished to Contractor. Contractor is directed to Section 9-1.04 of this Invitation for Bids.

4-1.05C Compensation for Altered Quantities: Payment and compensation for altered quantities shall conform to the provisions of Section 9-1.06 of the Standard Specifications, except as modified herein.

5 CONTROL OF WORK

5-1.02 Contractor's Copies of Contract Documents: In the event of a conflict in any of the Contract Documents, the order of precedence from highest to lowest shall be as follows:

1. Special Provisions
2. Project Plans, consisting of 68 sheets entitled Finley Aquatic Center Spray Ground and Renovation Project, 2022-014
3. City Standards
4. City Specifications
5. Standard Specifications
6. Standard Plans

5-1.05 Order of Work: The work as shown on the Project Plans and as specified in the Invitation for Bids shall be constructed in a sequence that is satisfactory to and approved by the Engineer.

Contractor shall prepare a work schedule per Section 8-1.02 of the Standard Specifications.

With the exception of trenching, all existing street, street light base, curb and gutter, storm drain, water line, and sewer line work shall be completed before any existing street paving is removed.

Full compensation for the conformance to the requirements of this section is included in the Contract price and no additional allowance will be made to Contractor for this work.

5-1.17 Character of Workers: Contractor is directed to Section 5-1.17 of the Standard Specifications which states:

"If any subcontractor or person employed by the Contractor shall appear to the Engineer to be incompetent or to act in a disorderly or improper manner, he shall be discharged immediately on the request of the Engineer, and such person shall not again be employed on the work."

No additional compensation shall be granted to Contractor in the event City exercises any part of its rights under this section and any and all costs related to such exercise shall be borne by Contractor.

5-1.20 Cooperation with Other Entities: Attention is directed to Section 5-1.20 of the Standard Specifications.

Other construction including but not limited to utility, power, and pipe line relocation, may be in progress by other forces within and adjacent to the project area at the same time work is being performed under this Contract by Contractor.

Contractor shall cooperate with the forces performing other work, to the end that such forces may conduct their operations with as little inconvenience and delay as possible. Contractor shall grant such forces access to the project area as is reasonable and necessary to transport materials and equipment to the site of operations by the other forces.

5-1.20B(4)(a) Offsite Staging Areas and Construction Yards: Attention is directed to Santa Rosa City Code section 20-52.040, Temporary Use Permit.

A Temporary Use Permit shall be obtained for any offsite construction yard on private property to be used for any of the following:

- a. Stockpiling of equipment and/or materials;
- b. Staging of construction;

- c. Placement of work trailers or mobile offices;
- d. Storage of trench spoils; or
- e. Other construction related activities not specifically enumerated above.

5-1.26 Lines and Grades: Contractor shall carefully preserve all bench marks, grade stakes, and all other survey markers. In the case of willful or careless destruction, Contractor shall bear the cost of replacing the markers.

Contractor shall contact the Engineer directly for coordination of survey staking. Written staking requests must be submitted at least two working days in advance of the date and time stakes are needed.

5-1.27B Examination and Audit: Pursuant to California Government Code section 8546.7, any contract with the City involving expenditures in excess of \$10,000 shall be subject to the examination and audit of the California State Auditor for a period of three years after final payment is made to Contractor by City under this Contract. Any such examination and audit will be confined to those matters connected with the performance of this Contract.

5-1.30A Inspection: Contractor shall bear all costs associated with the re-inspection of any defective, rejected or unauthorized work as determined by the Engineer in Engineer's sole discretion. Such costs of re-inspection, including any costs incurred by the City for additional staff time or fees for third-party consultant inspectors, will be deducted from one or more progress payments hereunder.

5-1.36A Property and Facility Preservation: Attention is directed to Section 5-1.36 of the Standard Specifications.

At Contractor's sole expense, all fences, gates, landscaping, drainage ditches, sidewalks, irrigation systems, and any other improvements that are damaged, removed or destroyed because of Contractor's operations, shall be replaced in accordance with City Standards at a minimum and restored to the same or better condition. Concrete surface treatment and score marks shall match adjacent existing concrete improvements.

5-1.36E Obstructions: Attention is directed to Section 5-1.36 of the Standard Specifications and to the possible existence of underground gas mains, high voltage lines, telephone ducts, storm drains and water and sewers systems, the locations of which are not shown on the Project Plans. The determination of the location of these facilities and the cost of repair or replacement in the event of damage to such facilities are the sole responsibility of Contractor.

Should Contractor alter any public utility or private improvements to facilitate its operations or for its sole benefit, which alteration would not be otherwise required, Contractor shall make whatever arrangements are necessary with the owner or controlling authorities and shall bear all expenses in connection therewith. Any damages to any public utility or private improvement caused by Contractor shall be repaired by Contractor at its sole expense and to the full satisfaction of the Engineer or the controlling authority.

Any subsurface information and data furnished under any part of this Contract are not intended as a representation or warranty but are furnished for information only. It is expressly understood that the City will not be responsible for the accuracy thereof or for any deduction, interpretation or conclusion drawn therefrom by Contractor. The information is made available so that Contractor may have ready access to the same information available to the City and is not part of this Contract.

PRIOR TO STARTING ANY EXCAVATION, CONTRACTOR SHALL (AT LEAST TWO WORKING DAYS IN ADVANCE) CALL UNDERGROUND SERVICE ALERT (USA) toll free at (800) 227-2600 and provide USA with all necessary data relative to the proposed excavation. USA will accept calls and process information to participating agencies who have underground facilities in the area

between the hours of 7:30 a.m. and 5:00 p.m. daily, except Saturdays, Sundays, and holidays. Between the hours of 5:00 p.m. and 7:30 a.m., calls will be recorded and then processed after 7:30 a.m. For emergency situations, after hours, and on Saturdays, Sundays and holidays, Contractor shall contact the owner of the affected facility.

Contractor shall coordinate all work with the appropriate City field personnel. When City work forces are required at the job site to perform Contract items of work, Contractor shall give a minimum of two working days advanced notification to the appropriate field office:

Water Division:	(707) 543-4200
Sewer Division:	(707) 543-4200
Street Division:	(707) 543-3880
Survey Division:	(707) 543-3834

5-1.43 Potential Claims and Dispute Resolution: "Claim" means a separate demand by Contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following: (A) A time extension, including, without limitation, for relief from damages or penalties for delay assessed by the City under the Contract; (B) Payment by the City of money or damages arising from work done by, or on behalf of, Contractor pursuant to the Contract and payment for which is not otherwise expressly provided or to which the claimant is not otherwise entitled; or (C) Payment of an amount that is disputed by the City.

Upon receipt of a Claim, the City shall conduct a reasonable review of the Claim and, within a period not to exceed 45 days, shall provide Contractor a written statement identifying what portion of the Claim is disputed and what portion is undisputed, provided, the parties may extend the 45 day time period by mutual agreement.

If the City needs approval from the City Council to provide the claimant a written statement identifying the disputed portion and the undisputed portion of the Claim, and the Council does not meet within the 45 days or within the mutually agreed to extension of time following receipt of a Claim, the City shall have up to three days following the next duly publicly noticed meeting of the City Council after the 45-day period, or extension expires to provide Contractor a written statement identifying the disputed portion and the undisputed portion.

Any payment due on an undisputed portion of the Claim shall be processed and made within 60 days after the City issues its written statement. If the City fails to issue a written statement, the Claim shall be deemed rejected in its entirety.

If a Contractor disputes the City's written response, or if the City fails to respond to a Claim within the time prescribed, the Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, the City shall conduct a meet and confer conference within 30 days for settlement of the dispute. Within 10 business days following the conclusion of the meet and confer conference, if the Claim or any portion of the Claim remains in dispute, the City shall provide the Contractor a written statement identifying the portion of the Claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the Claim shall be processed and made within 60 days after the City issues its written statement. Any disputed portion of the Claim, as identified by Contractor in writing, shall be submitted to nonbinding mediation, with the City and the Contractor sharing the associated costs equally. The City and Contractor shall mutually agree to a mediator within 10 business days after the disputed portion of the Claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the Claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator.

6 CONTROL OF MATERIALS

6-2.01 Source of Supply and Quality of Materials: All materials required to complete the work under the Contract shall be furnished by Contractor and shall be free of hazardous substances.

6-3.01 General: Statistical means will not be used by the City for determination of Standard Specification compliance. Whenever both operating range test results and Contract compliance requirements are specified in these special provisions, the operating range requirements shall apply to the individual test results.

6-3.01A Material Submittals: Upon award of the Contract by City, Contractor shall submit to the Engineer a list of all materials proposed to be used on this project and any supporting documentation and/or samples required and source of supply.

For material listed on the "Engineer's List of Approved Items" which is located in the Sewer and Water sections only of the City Standards, the Engineer shall be provided with the name of the manufacturer and model/part number for all material proposed for this project, unless that item has been replaced as shown on the Project Plans or in the Invitation for Bids.

For all other materials used on this project, regardless of the type of work, Contractor shall provide to the Engineer the name of the manufacturer and model/part number along with supporting documentation and/or samples that will allow the Engineer to determine the material's acceptability.

The Engineer reserves the right to reject any proposed material, whether on the City's "Engineer's List of Approved Items" or not. If the City obtains information indicating that a listed item is not performing satisfactorily or is found to be defective, that item will be rejected and Contractor shall submit a replacement for review at no additional cost to the City.

6-3.01B Material Guarantee: Before any contract is awarded, the bidder may be required to furnish samples of materials and detailed descriptions of equipment to be used in the construction of the project. The materials samples may be subjected to the tests provided for in the Standard Specifications or in this Invitation for Bids to determine their quality and fitness for the project. The successful bidder shall unconditionally guarantee project materials and workmanship for a period of one year from the date of recording of the Notice of Completion. The guarantee shall cover 100% of all costs of repairs within the one year period, including all costs of labor, materials, equipment, and incidentals. Except as may be otherwise provided in Section 3-1.05, the successful bidder shall provide a surety bond executed by a corporate surety authorized and admitted to transact a surety business in the state of California in the minimum amount of one-half of the Contract price to cover this guarantee.

6-3.05 Quality Assurance: California Test 216 (Relative Compaction) testing will be modified as follows: A mechanical compactor (Ploog Engineering Co. Model M 100 or equivalent) with 10-pound hammer and split compaction molds shall be used in lieu of the specified manual compaction equipment.

California Test 231 (Nuclear Gage Determination of In-Place Density) will be modified as follows: In-place density and relative compaction may be determined on the basis of individual test sites in lieu of the area concept, at the discretion of the Engineer.

6-4 Water Utility

6-4.01A Construction Water: All water required for the performance of the work shall be provided by Contractor. Prior to obtaining water from the City's water system, Contractor shall obtain a Water

Use Permit from the City of Santa Rosa Water Department and rent a hydrant or bridge meter. Contractor is responsible for the cost of all water and the cost of all deposits, permits and fees.

Contractor is prohibited from operating gate valves or fire hydrants on the City system.

The acquisition of water from the City's water system through un-metered hydrants or other facilities is a violation of City ordinance and State law. The use of water from sources other than the City's water system must be approved by the Engineer in advance of the use.

Citations and fines will be levied for violation of these and other utility regulations and deductions will be made from payments consistent with Section 7-1.02A(1) of the Standard Specifications.

6-4.01B Water Utility Notification: Contractors or parties requiring work of any kind by the City of Santa Rosa Water Department forces shall request such services a minimum of 48 hours in advance of the time such services are desired. Work requests which will involve the City of Santa Rosa Water Department forces for more than eight hours or an extensive number of City parts shall be requested a minimum of seven calendar days in advance.

If it is necessary to terminate or disrupt utility service to any customer, Contractor shall make the request for such work by City forces an additional 72 hours (three additional working days for a total of five working days advance notice) in advance of the time such services are desired to allow affected customers a minimum of 72 hours' notice. Contractors who fail to keep field appointments will be billed for scheduled City of Santa Rosa Water Department crew standby time which was used and the Contractor shall bear the costs incurred by the City of Santa Rosa's Water Department for re-notification of customers.

City of Santa Rosa Water Department crews work a 9/80 schedule. This schedule may prohibit shutdowns for tie-ins on alternating Fridays. After hours work or weekend work may be performed if prior authorization from the Engineer is obtained.

Other than the hours specified in this Invitation for Bids, requests by Contractor for after hours or weekend work is to be avoided whenever possible. Any overtime costs incurred by City for such work shall be borne by Contractor.

Interruption of utilities service to commercial customers shall be coordinated with the customer to minimize disruption to the enterprise to the greatest extent practicable. After notification by the Contractor of the need, the City of Santa Rosa Water Department will contact all commercial customers and inform Contractor accordingly.

6-4.01C Water Facility Damage: All damage caused to the City's water system shall be immediately reported to the Engineer.

Damage caused to the City's water system by Contractor's operations shall be repaired by the Contractor at Contractor's sole expense in a manner satisfactory to the City of Santa Rosa Water Department. Such repairs shall not be charged to the City or any City project. All repair work shall be witnessed and approved by the City of Santa Rosa Water Department prior to backfilling the excavation. The City will require re-excavation if backfilling occurs prior to inspection, which costs shall be borne by Contractor.

Contractor is responsible for, at its sole cost and expense, the repair and remediation of damage to property and facilities caused by any of the following circumstances:

- a. Contractor fails to make a written request for a markout or begins excavation without providing the City of Santa Rosa Water Department a reasonable opportunity to mark facilities;
- b. Contractor destroys markouts;

- c. Contractor fails to perform hand digging or probing for utilities near markouts; or
- d. Contractor fails to use reasonable caution, regardless of whether markouts are present or clear. Reasonable caution includes any efforts to avoid damaging existing facilities, such as when excavating in the vicinity of water mains.

City may, in its discretion, opt to make the repairs for which Contractor is responsible with its own forces. In such cases, the repairs will be made at Contractor's expense in accordance with the emergency repair rate schedule of the City of Santa Rosa Water Department. The City may make repairs whenever restoration of service requires extraordinary speed or special equipment. Contractor will be billed accordingly and City shall have the right and option to withhold payment hereunder, or a portion thereof, for any such costs billed but not promptly paid by Contractor.

6-4.02 Salvage: All valves, hydrants, and other appurtenances of the water system that are the property of City and removed by Contractor shall be delivered to the City's Municipal Services Center (55 Stony Point Road) unless Contractor has obtained specific written approval from the City of Santa Rosa Water Department to otherwise dispose of the materials.

6-4.03 Trade Names and Alternatives: Unless otherwise specified, material and equipment specifications that identify a particular patent, trade name or manufacturer, may be satisfied through substitute materials and equipment accepted by the City. Contractor may offer substitute materials and equipment of equal or better quality to the City. Any such offer shall be made in writing to the Engineer at least four weeks in advance of the time Contractor wishes to order the materials or equipment. Contractor shall include sufficient data which, together with any other information the Engineer may require, will enable the Engineer to determine the acceptability of the materials and equipment. When the substitute materials or equipment necessitate changes to any part of the work, the information shall include drawings and details showing all such changes and Contractor shall perform these changes as a part of any acceptance of substitute materials or equipment. The use of substituted materials and equipment will be permitted only after written acceptance of the materials and equipment by the Engineer. Such acceptance shall not relieve the Contractor from full responsibility for the sufficiency, quality and performance of the substitute materials and equipment.

The City will not, under any circumstances, acknowledge or consider any offers to accept substitute materials or equipment between the dates of public notice of advertisement and the bid opening.

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

7-1.02A(1) Forfeitures for Health and Safety Violations: Contractor shall comply with all applicable provisions of the Santa Rosa City Code and any failure to do so shall constitute a breach of the Contract. In the event of any violation of the Santa Rosa City Code that may impact public health and safety, including, but not limited to Chapter 17-12, "Storm Water" and Chapter 13-04, "Street Encroachments," City shall have the right to impose a charge against Contractor in an amount equal to \$500.00 per violation per day. Prior to the imposition of any charge hereunder, City shall first provide a written notice to Contractor of the violation and setting forth a reasonable period of time for Contractor to cure the violation(s). In the event Contractor fails to cure any such violation within the time provided, City shall have the right, in addition to all other rights and remedies available to City, to deduct and withhold as a permanent forfeiture by Contractor the appropriate amounts from any payment otherwise due Contractor under this Contract.

7-1.02K(2) Wages: Pursuant to Labor Code sections 1770 *et seq.*, each laborer or mechanic of Contractor or any subcontractor engaged in work on the project under this contract shall be paid not less than the hourly wage rate of per diem wages set forth in the prevailing wage rate schedule published by the Director of Industrial Relations, regardless of any contractual relationship which may be alleged to exist between Contractor or any subcontractor and such laborers and mechanics. A copy of the schedule of prevailing wage rates can be obtained online at www.dir.ca.gov or from the Department of Transportation and Public Works at 69 Stony Circle, Santa Rosa.

Any laborer or mechanic employed to perform work on the public works project under this Contract, which work is not covered by any of the foregoing classifications, shall be paid not less than the prevailing wage rate of per diem wages specified herein for the classification which most nearly corresponds to the work to be performed by the worker.

The foregoing specified prevailing wage rates are minimum rates only, and Contractor may pay any wage rate in excess of the applicable rate.

Pursuant to Labor Code Section 1775, Contractor as a penalty to the owner shall forfeit not more than \$200.00 for each calendar day, or a portion thereof, for each worker paid less than the prevailing wage rate established by the Department of Industrial Relations for such work or craft in which such worker is employed. The difference between such prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which the worker was paid less than the prevailing wage rate shall be paid to each worker by Contractor.

Contractor shall only provide prevailing wage reports upon written request from City. When requested, these prevailing wage reports must be redacted by the Contractor prior to providing them to City.

7-1.02K(4) Apprentices: Contractor agrees to comply with Chapter 1, Part 7, Division 2, sections 1777.5 *et seq.* of the California Labor Code. These sections require contractors and subcontractors to employ apprentices in apprenticeable occupations in a ratio of not less than one hour of apprentice work for each five hours of journeyman work (unless an exception is granted in accordance with Section 1777.5), and the contractors and subcontractors shall not discriminate among otherwise qualified employees as apprentices solely on the ground of sex, race, religion, creed, national origin, ancestry, or color. Only apprentices as defined in Labor Code section 3077, who are in training under apprenticeship standards and who have written apprentice agreements will be employed on public works in apprenticeable occupations. The responsibility for compliance with these provisions is fixed with the prime contractor for all apprenticeable occupations.

7-1.02K(6)(a)(1) Notice to Vendors: Attention is directed to the current OSHA Standards. All equipment, tools and materials which are furnished and/or installed as part of this Contract shall meet or exceed the aforementioned standards in order to be considered acceptable.

7-1.02K(6)(b) Excavation Safety: When the digging or excavation occurs during project construction, Contractor shall:

- a. Promptly notify City in writing of the following conditions before any such conditions are disturbed:
 1. Material that the Contractor believes may be hazardous waste as defined in Health and Safety Code section 25117 that 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 in the Invitation for Bids; and
 3. Physical conditions at the site of any unusual nature, materially different from those ordinarily encountered and generally recognized as inherent in the type of work under the Contract.
- b. The City will investigate the conditions and will issue a change order under the terms of the Contract if it finds that the conditions warrant it.
- c. If a dispute arises between City and Contractor as to whether a change order is warranted, Contractor shall not be excused from any scheduled completion date provided for in the Contract but shall proceed with all work to be performed under the Contract.

7-1.02K(6)(b)(1) Trench Excavation Safety Plans: When the estimated cost for the excavation of any trench or trenches five feet or more in depth will exceed \$25,000.00, Contractor shall submit to the Engineer in advance of excavation a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the shoring system standards established by the construction safety orders, or if the trench is anticipated to be greater than 20 feet, the plan shall be prepared by a registered civil or structural engineer.

A permit to do the above described work shall be obtained from the State of California, Division of Industrial Safety. Proof of such permit shall be submitted to the Engineer prior to starting the trench work.

Full compensation for complying with the provisions of this section shall be considered as included in the Contract price and no additional allowance will be made for the work.

7-1.02K(6)(d) Confined Space Safety: Any confined space entry for this project, including but not limited to manhole or water storage tank entry, will require a confined space entry permit pursuant to Cal/OSHA regulations as set forth in title 8 California Code of Regulations (CCR) sections 5157 or 5158. Confined space entry shall have the meaning ascribed in title 8 CCR sections 5157 and 5158. For any confined space entry for construction operations regulated by title 8 CCR section 1502, Contractor shall comply with title 8 CCR section 5158, "Other Confined Space Operations." For any other confined space operations, Contractor shall comply with title 8 CCR section 5157, "Permit-Required Confined Spaces."

Attention is directed to the technical specifications in the Special Provisions for information regarding entry to any City maintained confined space. Pursuant to title 8 CCR section 5157, Contractor is required to obtain any available information regarding hazards and operations for any City maintained confined spaces. The City maintained Confined Space Entry Manual is available for viewing at the City of Santa Rosa Water Department or Transportation and Public Works Department office at 69 Stony Circle, Santa Rosa.

Contractor shall immediately inform the Engineer of any previously unidentified hazards confronted or created during confined space entry.

7-1.02L(2)(a) Patents and Royalties: All fees, royalties, or claims for any patented invention, article, process or method that may be used upon or in any manner connected with the work under this Contract shall be paid by Contractor. Contractor and its sureties shall protect and hold harmless City and its officers, agents, and employees from any and all demands made for such fees royalties or claims brought or made by any third party, and before the final payment is made on the account of the Contract, Contractor shall, if requested by City, furnish acceptable proof of a proper release from all such claims and liabilities.

Should Contractor, its officers, agents, or employees, or any one of them be enjoined from furnishing or using any invention, article, material, or plans supplied or required to be supplied or used under the Contract, Contractor shall promptly substitute other articles, materials, or appliances in lieu thereof of equal efficiency, quality, finish, suitability, and market value, and satisfactory in all respects to the Engineer. In the event that the Engineer elects, in lieu of such substitution, to have supplied and to retain and use any such invention, article, materials, or plans as may be required to be supplied by the Contract, Contractor shall pay such royalties and secure such valid licenses as may be requisite and necessary for City, its officers, agents, and employees, or any one of them to use such invention, article, materials, or appliance without being disturbed or in any way interfered with by any proceeding in law of equity on account thereof. Should Contractor neglect or refuse to make the substitution promptly or to pay such royalties and secure such licenses as may be necessary, then in that event the Engineer shall have the right to make such substitutions or City may pay such royalties and secure such licenses and charge Contractor even though final payment under the Contract may have been made.

7-1.02M(3) Mined Materials: California Public Contract Code section 20676 prohibits surface mining operators which are subject to the Surface Mining and Reclamation Act of 1975 (SMARA) from selling California mined construction material to the City unless the operator is identified in a list referred as the **3098 List**. The List, which is maintained by the Department of Conservation's Office of Mine Reclamation (OMR), changes throughout the year and can be viewed at the OMR website: http://www.consrv.ca.gov/OMR/ab_3098_list/index.htm. To confirm whether or not a specific operator is on the List at any given time, Contractor shall call the OMR at (916)323-9198.

7-1.03A Maintaining Traffic: Attention is directed to Sections 7-1.04 of the Standard Specifications and to the following modifications thereof.

If construction is within City owned right-of-way, provisions shall be made for the safe passage of public traffic through the work site at all times consistent with the requirements of Santa Rosa City Code Chapter 13-04.

Except for projects to be performed under a minor contract, Contractor shall install and maintain project identification signs at each end of the project or as directed by the Engineer two weeks prior to any construction activity. City shall furnish the appropriate sign panels upon request from Contractor. To mount the sign panels, Contractor shall furnish and install 4" X 4" posts or mount by other appropriate methods as approved by the Engineer. These sign panels shall be returned to the City Corporation Yard at 55 Stony Point Road after completion of the project.

Two weeks prior to any construction activity, advance notice signs for road closures shall be furnished and installed by Contractor at each end of the project and shall remain in place throughout the duration of the subject closure. Details of panel construction and lettering shall be approved by the Engineer.

Contractor shall furnish, install, and maintain at its expense all barricades, signs, lights, and other devices necessary to adequately warn of any obstructions to the traveled and pedestrian way and provide flaggers as necessary for the safety of public traffic and pedestrians and to provide access to property adjacent to the work site and Contractor shall comply with the Americans with Disabilities

Act of 1990 (42 U.S.C. 12101, *et seq.*) (ADA) and any regulations and guidelines issued pursuant to the ADA.

Contractor shall comply with the current edition of the California Manual of Uniform Traffic Control Devices (CA MUTCD) for all items related to traffic within the work site.

Rain and other occurrences that may cause the suspension or delay of the work shall in no way relieve Contractor of its responsibility to provide traffic control and public access through the work site as specified herein. At all times, Contractor shall keep at the work site such materials, forces and equipment as may be necessary to keep roads, streets, and driveways within the work site open to traffic and in good repair and shall expedite the passage of such traffic, using such forces and equipment as may be necessary.

Should Contractor fail, in the opinion of the Engineer, to provide all the materials, forces and equipment necessary to maintain traffic through the work site as set forth herein, City may take steps necessary to remedy any such failure, including but not limited to causing such work to be performed and/or suspending any further work under the Contract. Any such remedial cost and expense incurred by the City, plus an administrative charge of 15%, shall be immediately due and payable by Contractor and may be deducted from any amounts owed to Contractor hereunder. In the event there are insufficient sums owed to Contractor hereunder to cover the foregoing costs and charges, City shall have the right to pursue any other remedy to recover the same, including but not limited to, proceeding against any surety or bond in favor of City. City's rights under Section 7-1.02 are intended to be in addition to and not in lieu of any charges imposed by City against Contractor under Section 7-1.02A(1) above for violations of the Santa Rosa City Code.

Contractor shall be responsible for informing emergency response agencies operating within the area of the work of obstructions to either public or private roads caused by reason of Contractor's operations hereunder.

Contractor shall make provisions for the safe passage of pedestrians around the project work site at all times.

8 PROSECUTION AND PROGRESS

8-1.01A Assignments: Once awarded, this Contract shall not be transferred, assigned, or sub-contracted, except as herein expressly provided without the prior written consent of the City in the City's sole and absolute discretion. See Section 5-1.12 of the Standard Specifications.

8-1.04C Electrical Materials Start:

8-1.04B Standard Start: Contractor shall begin work within ten calendar days after the date authorized in the Notice to Proceed and shall diligently prosecute the Contract to completion before the expiration of:

90 WORKING DAYS

8-1.05 Time: Working days will be counted beginning with the day the Contractor begins work or with the tenth day after the date authorized in the Notice to Proceed, whichever occurs first.

The Contractor may work Saturdays upon request from the Engineer.

Unless otherwise directed by Engineer, Contractor shall not conduct any activities that generate noise earlier than 7:00 a.m. or later than 7:00 p.m.

8-1.10 Liquidated Damages: Contractor hereby agrees that Contractor shall pay to the City liquidated damages for each and every calendar day delay over and above the number of working days prescribed above for finishing the work in the amount shown in Section 8-1.10 of the Standard Specifications.

9 MEASUREMENT AND PAYMENT

9-1.04 Force Account Work: All work done on a force account basis shall be recorded daily on report sheets prepared by Contractor and signed by both the Engineer and Contractor. Such reports shall thereafter be considered the true record of force account work performed during the project. Such reports shall be furnished to the Engineer and a copy retained by Contractor.

All extensions of labor, equipment, and material costs shall be completed by Contractor and submitted to the Engineer within 30 days of the completion of the extra work. Completed and extended extra work reports received later than the times herein prescribed may be deemed invalid and rejected without payment at the discretion of the Engineer.

9-1.07 Payment Adjustments For Price Index Fluctuations: Any references to Opt Out of Payment Adjustments for Price Index Fluctuations in the Standard Specifications are deleted in their entirety.

9-1.16 Progress Payments: Once each month for progress pay purposes, the City will prepare a written estimate of the total amount of completed work and accepted materials purchased by Contractor but not installed. The City shall retain five percent of such estimated value of the completed work and the unused materials and pay Contractor the balance after deducting all previous payments and all sums to be retained under the provisions of the Contract. No such estimate or payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the Contract or when, in the Engineer's judgment, the total value of the completed work since the last estimate is less than \$500.00. No such estimate or payment shall be construed to be an acceptance of any defective work or improper materials.

After Contract acceptance, the Engineer will prepare a written proposed final estimate of the proposed final quantities of work completed under the Contract and the value of such work and will submit such estimate to Contractor. The City shall retain five percent of such estimated value of the work done and shall pay to Contractor the balance after deducting all amounts to be retained under the provisions of the Contract.

The City may, at its option and at any time, retain out of any amounts due Contractor sums sufficient to cover any unpaid claims of City or others, provided that sworn statements of all non-City claims shall have been filed with the Director of Finance.

9-1.16E(6) Substitution of Securities for Withheld Amounts: Pursuant to Public Contract Code section 22300, securities may be substituted for any moneys withheld by City to ensure performance under this Contract, provided that substitution of securities provisions shall not be required in contracts in which there will be financing provided by the Farmer's Home Administration of the United States Department of Agriculture pursuant to the Consolidated Farm and Rural Development Act (7 USC sections 1921 *et seq.*), and where federal regulations or policies or both do not allow the substitution of securities. At the request and expense of Contractor, securities equivalent to the amount withheld shall be deposited with the City, or with a state or federally chartered bank as the escrow agent, which shall then pay such moneys to Contractor. The Director of Finance is authorized to execute substitution of securities agreements on behalf of the City. The City will return the securities to Contractor upon satisfactory completion of the Contract as determined by City in its sole discretion and the resolution of all outstanding claims against the securities. Contractor shall be the beneficial owner of any securities substituted for moneys withheld and shall receive any interest thereon.

Securities eligible for investment under this section shall include those listed in Government Code section 16430, bank or savings and loan certificates of deposit, interest bearing demand deposit accounts, standby letters of credit or any other security mutually agreed to by Contractor and the

City, provided that the substituted security is equal to or not less than five percent of the Contract amount.

Security substitutions must be submitted by Contractor and approved by City prior to the time of the first progress payment to be made under the Contract. No other method of substituting securities for retention will be accepted. The security substitution shall be done only upon execution of an agreement satisfactory to City which includes the following provisions:

- a. The amount of securities to be deposited;
- b. The terms and conditions of conversion to cash in case of the default of Contractor; and
- c. The procedure for return of securities upon completion of the Contract.

9-1.17D Final Payment and Claims: The processing of payment of the final estimate shall not be commenced less than 35 days after the date of recording of the Notice of Completion with the County Recorder's Office. Contractor is advised that it takes approximately ten days for a check to be issued following a request for payment.

Contractor shall submit its written statement of all claims for additional compensation under the Contract to the Engineer within 15 days after submission to Contractor of the proposed final estimate.

If Contractor does not file a claim within the 15 day period, or upon Contractor's approval, the Engineer will issue a final written estimate and the City shall pay to Contractor the entire sum due after deducting all previous payments, if any, and all amounts to be retained under the provisions of the Contract.

If Contractor files a claim within the 15 day period, the Engineer will furnish a semi-final estimate and pay the amount due under the semi-final estimate within 30 days. The semi-final estimate is conclusive as to the amount payable except as may be affected by claims and any amount retained. The Engineer shall then consider and investigate such claim and shall make such revision in the final quantities as the Engineer may find to be due and shall then make and issue a final written estimate. The City will pay the amount due, after deducting all previous payments, if any, and amounts to be retained under the provisions of the Contract.

Any and all prior partial estimates and payments shall be subject to correction in the final estimate and payment.

The final estimate shall be conclusive and binding against both parties to the Contract on all questions relating to the performance of the Contract and the amount of work done thereunder and compensation therefor, except in the case of gross error.

9-1.17D(3) Final Determination of Claims: Claims filed by Contractor shall be in sufficient detail to enable the Engineer to determine the basis and amount of the Claims. Contractor shall also furnish reasonable documentation to the City to support Claims. If additional information is required by the Engineer, Contractor shall provide such information to the Engineer no later than the 15th day after receipt of the written request from the Engineer. If the 15th day falls on a weekend, holiday, or day City offices are closed, then the information shall be provided to the Engineer no later than close of the next business day. Failure to submit the requested information to the Engineer within the time specified will be sufficient cause for denying the Claim.

Contractor shall keep full and complete records of the costs and additional time incurred for any work for which a claim for additional compensation is made. The Engineer or any designated Claim investigator or auditor shall have access to those records and any other records as may be reasonably required by the Engineer to determine the facts or contentions in each Claim. Failure to grant access to such records shall be sufficient cause for denying the Claims.

9-1.22 Arbitration: Any references to Arbitration in the Standard Specifications are deleted in their entirety.

Claims submitted by Contractor shall be accompanied by a notarized certificate containing the following language:

Under the penalty of law for perjury or falsification and with specific reference to the California False Claims Act, Government Code sections 12650 *et seq.*, the undersigned,

_____,
(Name)

_____ of
(Title)

(Contractor)

hereby certifies that the claim for additional compensation made herein is supported by a true statement of the actual costs incurred and time expended on this project and is fully documented by records maintained by Contractor.

Dated _____

/s/ _____

Subscribed and sworn before me this _____ day of

Notary Public

My Commission Expires _____

Failure to submit the notarized certificate will be sufficient cause for denying the claim.

Any claim for overhead expenses, in addition to being certified as stated above, shall be supported by an audit report of an independent Certified Public Accountant. Any such overhead claim shall also be subject to audit by the City at its discretion.

Any costs or expenses incurred by the City in reviewing or auditing any claims that are not supported by Contractor's cost accounting or other records shall be deemed to be damages incurred by the City within the meaning of the California False Claims Act.



TECHNICAL SPECIFICATIONS

FOR

**FINLEY AQUATIC CENTER SPRAY GROUND
AND RENOVATION PROJECT**

CONTRACT NO. C02336



2023

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

This Section includes:

- A. Work covered by the Contract Documents.
- B. Type of Contract.
- C. Work phases.
- D. Work under other contracts.
- E. Products ordered in advance.
- F. Owner-furnished products.
- G. Use of premises.
- H. Owner's occupancy requirements.
- I. Work restrictions.

1.03 RELATED SECTIONS INCLUDE:

- 1. Section 01 50 0 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

PART 2 - PROJECT INFORMATION

- A. Project Title: Finley Aquatic Center Spray Ground and Renovation Project: Contract No. C02336
- B. Project Location: 2060 W College Ave, Santa Rosa, CA 95401
- C. Owner: City of Santa Rosa, 55 Stony Point Road | Santa Rosa, CA 95401

2.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work consists and includes but is not limited to:
Furnish all labor, materials, equipment and services as required to satisfactorily complete all Work required for the demolition of existing pool deck, landscaping and pool, and the construction and completion of replacement pool deck and associated safety equipment and markings, new picnic and synthetic turf areas, landscaping, splash pad and associated mechanical, plumbing, electrical and drainage work. All existing pool areas to remain or to be renovated are to be restored to original or improved functionality per plans at the completion of the project.

PART 3 - WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with Owner's separate contractors, if any, so work on those contracts may be carried out smoothly, without interfering or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts, if any.

PART 4 - USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as directed by the Owner and as shown on the drawings.
- B. Use of Site: Limit use of premises to areas within Contract limits. Do not disturb portions of Project site beyond areas in which the "Allowed Work Areas" are indicated.
- C. Provide for emergency vehicles at all times.
1. This Contractor shall utilize chain link fencing, traffic control and signage around all site work during construction at ALL TIMES for the safety of Finley Community Park staff and students. Contractor shall assume that Facility access paths must remain open and operating at all times during This Contractor's Work activities.
 2. Limits: Allow for Owner occupancy of Project site.
 - a. Access paths, Driveways, Entrances, and Pedestrian pathways: Keep driveways, parking areas, loading areas, entrances, and pedestrian pathways serving premises as clear as construction operations will allow. Remove temporary fencing and clean work areas as soon as work areas are completed.
 - b. Temporary storage of materials will be allowed on a case-by-case basis. Contractor will be allocated a designated area or areas on Facility for site utilization, storage, and parking.
 - 1) Schedule deliveries to minimize use of driveways and entrances.
 - 2) Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Do not unreasonably encumber site with materials or equipment. Confine stockpiling of materials and location of storage areas to areas as directed by Owner's authorized representative.
- E. Smoking or open fires are prohibited on facility.

PART 5 - OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will not occupy the facility during the majority of the construction period, with the exception of completed areas of construction, particularly the renovated instructional and recreational pools. Coordinate with Owner towards the end of construction to facilitate Owner usage and minimize conflicts with pool programming beginning May 1, 2024. Perform remainder of Work so as not to interfere with Owner's operations. Maintain access to areas of the Finley Center and Community Park adjacent to the aquatic center such as existing exits, vehicular routes and parking areas, and pedestrian paths, unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than five working days notice to Owner of activities that will affect Owner's operations. Coordinate with Construction Manager for advance notice of construction and impediments to the Facility operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and use the completed areas of site, particularly the renovated instructional and recreational pools before or closely thereafter Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such accommodation and partial occupancy shall not constitute acceptance of the total Work.
1. Owner desires to occupy and use the renovated instructional and recreational pools beginning May 1, 2024, and possibly in advance of Substantial Completion.
 2. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 3. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 4. Before partial Owner occupancy, utility, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of the facility.
 5. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of the facility.

PART 6 - WORK RESTRICTIONS

- A. The construction hours / days of Work at the Site are 7:30 am to 7:00 pm Monday through Friday. Saturday construction hours are 9:00 am to 5:00 pm, special circumstances Saturday and Sunday work must be pre-approved by the City in writing coordinated with and by the Construction Manager.
- B. Do not perform the following types of work until written agreement as to allowable times has been obtained from Owner:
1. Work involving utility shutdowns.
 2. Core drilling or other noisy activity.
- C. Construction Notifications shall be given as follows. Contractor shall not proceed with the work or with shutdowns or interruptions until authorized by the Construction Manager in writing:

1. This Work is anticipated to involve daily operations in and around Facility access roadways and pedestrian pathways. Contractor shall be required to update Construction Manager no less than each (3) days for areas of work so that proper Construction Notices may be posted for City and Facility staff in advance of construction activities.
2. For electrical power shutdowns anticipated to be less than 1 hour, provide written notice to the Construction Manager a minimum of three (3) work days in advance.
3. For electrical power shutdowns anticipated to be in excess of 1 hour, provide written notice to the Construction Manager a minimum of fourteen (14) work days in advance.
4. For domestic water and gas shut-offs, provide written notice to the Construction Manager a minimum of three (3) work days in advance.
5. For interruptions of low voltage systems such as fire alarm, communication, clock, signal, data and energy management systems, provide written notice to the Construction Manager a minimum of three (3) work days in advance.
6. For high impact activities including but not limited to crane operations, concrete pours, large special deliveries; traffic and road impacts, provide written notice to the Construction Manager a minimum of three (3) work days in advance.

END OF SECTION 01 11 00

**SECTION 01 22 00
MEASUREMENT AND PAYMENT**

PART 1 - GENERAL

1.01 SUMMARY

- A. Measurement and Payment for this project will be in accordance of Section 9 of the Standard Specifications and as modified in these technical provisions.
- B. This section describes the methods by which measurement will be made of the quantities for which payment will be made for the project. It is the intention of this Specification that payment will be made for those items listed in the Bid Schedule only. All items of work not specifically listed in the Bid Schedule shall be included in the prices for the various items listed on the bid schedule.
- C. All quantities shown in the bid schedule shall be assumed to include the furnishing of all labor, materials, tools, equipment, taxes, insurance, and incidentals required for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- D. Project will bid as a single lump sum.

PART 2 - UNITS OF MEASURE

2.01 GENERAL CONDITIONS (MAX 3%)

- A. General Conditions (Max 3%) shall include satisfying all provisions of the general specifications sections 1-9, and for facilitating project meetings, making submittals, providing operations and maintenance data, warranties, and keeping and maintaining record documentation and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.02 MOBILIZATION / DEMOBILIZATION (MAX 5%)

- A. Mobilization shall include the following:
 - 1. Obtaining of all bonds, insurance, and permits; moving onto the project site, inclusive of any staging areas, all equipment, personnel, and permanent and temporary facilities as required for the proper performance and completion of the Work.
 - 2. Arrangement with and payment for project staging areas with necessary responsible parties, inclusive of all necessary site investigation, reporting, permitting, traffic control, screened fencing, crushed rock surfacing (if required), storm water best management practices, and all other improvements upon the land and work associated with the establishment and ongoing maintenance of staging areas.
 - 3. moving on to the project site of all Contractor's equipment, personnel, and temporary and permanent facilities required for the project.
 - 4. Installing temporary construction power, wiring, and lighting facilities.
 - 5. Installing a minimum of two (2) project identification signs, including all necessary work to manufacture, label, place, maintain, remove, and dispose of such identification signs and all labor, materials, tools, and equipment in performing the work required per the Contract Documents.

6. Providing on site sanitary facilities and potable water facilities.
7. Furnishing, installing, and maintaining all storage buildings or sheds required for temporary storage of products, equipment, or materials that have not yet been installed in the Work. All such storage shall meet manufacturer's specified storage requirements, and the specific provisions of the specifications, including temperature and humidity control, if recommended by the manufacturer, and for all security.
8. Any work, coordination, hardware/software, Internet, and related technical or process-based activities associated with the project's web-based document management system.
9. Obtaining and paying for all required bonds, insurance, and permits and licenses.
10. Posting all OSHA required notices and establishment of safety programs.
11. Submittal of required Construction Schedule.
12. Conducting a pre-construction photographic survey of all work areas.

B. Mobilization

1. Maximum limit for Mobilization is 2.5% (two and one half percent) of the Total Bid Price.
2. Maximum limit for Demobilization is 2.5% (two and one half percent) of the Total Bid Price.
3. The aforementioned amount will be retained by the City as the agreed, estimated value of completing all of the mobilization items listed. Any such retention of money for failure to complete all such mobilization items as a lump sum item shall be in addition to the retention of any payments due to the Contractor as specified in Division 1 General Requirements.

2.03 ABNORMAL WEATHER CONDITIONS

- A. There shall be no increase in the contract sum, time, or remuneration of any kind by Owner to Contractor for extensions due to adverse weather conditions which fall within the parameters of the 10 year average.

2.04 EROSION CONTROL

- A. Erosion Control shall include all labor, materials, tools, equipment and incidentals and for doing all work involved in placing, removing, storing, maintaining as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.05 TREE PRESERVATION & PRUNING

- A. Tree Preservation & Pruning shall include but not be limited to protective fencing, root protection, organic mulch, irrigation, grading, clearing & grubbing, pruning, arborist services, and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.06 SITE PREPARATION & DEMOLITION

- A. Site Preparation & Demolition shall include but not be limited to clearing and grubbing, removal and disposal of paving's, utilities and features, and other miscellaneous items, tree removal and disposal and stump grinding, and export soil and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

1. **CONCRETE SIDEWALK REMOVAL:** Concrete Sidewalk Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
2. **CONCRETE POOL DECK REMOVAL:** Concrete Pool Deck Removal shall include but not be limited to, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
3. **CONCRETE POOL DECK REMOVAL (DARK CONCRETE):** Concrete Pool Deck Removal (Dark Concrete) shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
4. **CONCRETE POOL DECK REMOVAL (LAP POOL EDGE):** Concrete Pool Deck Removal (Lap Pool Edge) shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
5. **CONCRETE RETAINING CURB REMOVAL:** Concrete Retaining Curb Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
6. **HANDRAIL REMOVAL:** Handrail Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including recovery and salvaging of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
7. **AREA DRAIN REMOVAL:** Area Drain Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
8. **SLOT DRAIN REMOVAL:** Slot Drain Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
9. **15-INCH RCP STORM DRAIN REMOVAL:** 15-Inch RCP Storm Drain Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard

Specifications, and as shown in these Special Provisions.

10. **8-INCH DIP SANITARY SEWER REMOVAL:** 8-Inch DIP Sanitary Sewer Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
11. **POOL AND POOL EQUIPMENT REMOVAL:** Pool and Pool Equipment Removal shall include but not be limited to, furnishing all labor, materials, tools, equipment, and incidentals, including disposal of removed materials, environmental compliance, sawcutting, for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

2.07 SITE GRADING

- A. Site Grading shall include but not be limited to all earth moving activities, fine grading and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved in stripping, stockpiling, placing, excavation and/or structural fill complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
 1. Earthwork shall include but not be limited to, furnishing all labor, materials, tools, equipment and incidentals for doing all work involved in earthwork, excavation, scarification, and finish grading as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

2.08 PEDESTRIAN CONCRETE PAVING

- A. Pedestrian Concrete Paving including subgrade preparation shall include but not be limited to all labor, materials, tools, equipment and incidentals and for doing all pedestrian concrete paving work including of integral color concrete paving and standard grey concrete paving complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- B. Pedestrian Concrete Paving includes Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements.

2.09 SPLASH PAD CONCRETE PAVING

- C. Splash Pad Concrete Paving including subgrade preparation shall include but not be limited to all labor, materials, tools, equipment and incidentals and for installing integral color concrete paving work within the splash pad area as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- A. Splash Pad Concrete Paving includes Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements.

2.10 CONCRETE CURBS

- A. Concrete Curbs including footings and subgrade preparation shall include but not be limited to all labor, materials, tools, equipment and incidentals and for installing 6” wide concrete curbs and 12” wide concrete curbs as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- B. Concrete Curbs include Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements.

2.11 POOL DECK REPAIR

- D. Pool Deck Repair shall include but not be limited to removal and replacement of concrete pool deck including light and dark concrete and lap pool edge, retaining curbs, handrails, area drains, slot drains and miscellaneous pool equipment such as start blocks, warning tiles, depth indicators, hand rails etc. and associated earthwork within the scope of work.
- A. Concrete Pool Deck shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in sawcutting, asphalt removal, earthwork, disposal of unsuitable materials, preparing the subgrade, scarification and re-compaction of subgrade, furnishing and compacting the aggregate base, doweling into the existing concrete, furnishing and placing of rebar, connection to existing sidewalk, furnishing and placing concrete, furnishing and placing curing compound, landscape replacement and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- B. CONCRETE POOL DECK (DARK CONCRETE): Concrete Pool Deck (Dark Concrete) shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in sawcutting, asphalt removal, earthwork, disposal of unsuitable materials, preparing the subgrade, scarification and re-compaction of subgrade, furnishing and compacting the aggregate base, doweling into the existing concrete, furnishing and placing of rebar, connection to existing sidewalk, furnishing and placing concrete, furnishing and placing curing compound, landscape replacement and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- C. CONCRETE POOL DECK (LAP POOL EDGE): Concrete Pool Deck (Lap Pool Edge) shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in sawcutting, asphalt removal, earthwork, disposal of unsuitable materials, preparing the subgrade, scarification and re-compaction of subgrade, furnishing and compacting the aggregate base, doweling into the existing concrete, furnishing and placing of rebar, connection to existing sidewalk, furnishing and placing concrete, furnishing and placing curing compound, landscape replacement and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- D. CONCRETE RETAINING CURB: Concrete Retaining Curb shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- E. HANDRAIL: Handrail shall include but not be limited to furnishing all labor, materials, tools,

equipment and incidentals for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

- F. **ADJUST EXISTING UTILITY TO FINISHED GRADE:** Adjust Existing Utility to Finished Grade shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals for doing all work involved, as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- G. **MISCELLANEOUS POOL EQUIPMENT:** Miscellaneous Pool Equipment shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

2.12 RAISED PLANTER WALLS

- A. Raised Planter Walls including footings and subgrade preparation shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals and for installing raised planters as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- B. Raised Planter Walls include Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements.

2.13 FREESTANDING WALLS

- A. Freestanding Walls including footings and subgrade preparation shall include but not be limited to, materials, tools, equipment and incidentals and for installing raised planters as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- B. Freestanding Walls include Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements.

2.14 SITE RETAINING WALLS

- A. Site Retaining Walls including footings and subgrade preparation shall include but not be limited to, all labor, materials, tools, equipment and incidentals and for installing raised planters as shown on the plans, as specified in the Standard Specifications and these Special Provisions.
- B. Site Retaining Walls include Concrete forming, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements. All costs in connection therewith will be incidental to and included with the applicable items of work.

2.15 SITE FURNITURE

- A. Site Furniture shall include the installation of Picnic Tables, Accessible Picnic Tables, Concrete Beach Balls, Concrete Seat Pads, and Concrete Benches and shall include but not be limited to,

materials, tools, equipment and incidentals, inspections and for doing all work, complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.16 SHADE SAILS

- A. Shade Sails shall include the installation of Shade Sails ‘A’ and Shade Sails ‘B’ and shall include but not be limited to all materials, tools, equipment and incidentals, inspections and for doing all work, complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.17 SPRAY GROUND SYSTEM

- A. Spray Ground System shall include but not be limited to all water play features, footings, valves and piping, joint sealant, main drain supply, perimeter trench grate, 4500 gallon cistern recirculation pumps, filtration system, UV disinfecting system, sanitation, oxidation and pH system, recirculation system, sensors, shutoffs, natural gas fired heater, all miscellaneous materials connections and fittings and chemicals for a fully functional and complete sprayground system complete in place and shall include all bonding, labor, materials, tools, equipment and incidentals and for doing all work, complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.18 MECHANICAL BUILDING, CISTERN AND BACKWASH PIT

- A. Mechanical Building, Cistern and Backwash Pit shall include but not be limited to excavation and preparation and installation of cast-in-place concrete mechanical building, below grade cistern, and backwash pit, including all blockouts, Concrete Formliners, Portland cement, dowels, aggregates, curing, admixtures, finishing, sealants, waterproofing, reinforcement, saw cutting, joints, mockups, testing and analysis of materials, mix designs, batching, mixing, transportation, inspection, testing, repairs, and replacements, roof system, ventilation, doors, downspouts, tile waterfall wall, waterproofing, and all other architectural finishes and features for a full and complete mechanical room to house the sprayground system and shall include all labor, materials, tools, equipment and incidentals as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.19 PLUMBING SYSTEM

- A. Plumbing System shall include but not be limited to 1.5” domestic water pipe, site domestic cold water piping connections from civil piping within 5 feet of new pump building exterior to pool consultant provided backflow preventer, Storm drain connection from new pump building roof gutter to civil piping within 5 feet of building exterior. 1x floor sink, 2x floor cleanout, 1x backwash pit floor drain connection and sump connection from within new pump building to civil piping within 5 feet of building exterior. Include trap primer valve(s) and piping, gas lines, natural gas connection from civil piping within 5 feet of new pump building exterior to pool consultant provided gas fired pool heater and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.20 DRINKING FOUNTAIN & SHOWER UPGRADES

- A. Drinking Fountain & Shower Upgrades shall include but not be limited to new drinking fountains, accessible showers, anchoring, associated plumbing work, patch and repair work of existing wall, and shall include all labor, materials, tools, equipment and incidentals and for doing all planting work involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

Specifications and these Special Provisions.

2.21 MECHANICAL SYSTEM

- A. Electrical System shall include but not be limited to Gas pool heater flue exhaust and make-up supply ductwork to roof of new pool equipment room, 4" diameter, stainless steel flue and intake and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.22 ELECTRICAL SYSTEM

- A. Electrical System shall include but not be limited to power distribution to main panel, pull boxes, waterproofing, GFCI receptacles, electrical panels, transformers, feeders, conduit, and wiring and miscellaneous equipment connections, dimming control switches, timeclocks, exterior wall sconce and branch wiring, string lighting at shade sails, LED strip lighting at mechanical room, tree up lights and downlights on tree straps, miscellaneous electrical requirements and grounding allowance, and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.23 SNACK SHACK UPGRADES

- A. Snack Shack Upgrades shall include but not be limited to all required demolition and protection of existing work, new SS walls and finishes, SS Countertop modifications, rolling door modifications, any required miscellaneous plumbing and electrical work and shall include all labor, materials, tools, equipment and incidentals and for doing all planting work involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.24 STRIPING

- A. THERMOPLASTIC 4-INCH STRIPE: Thermoplastic 4-Inch Stripe shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- B. THERMOPLASTIC PAVEMENT MARKINGS: Thermoplastic Pavement Markings shall include but not be limited to, furnishing all labor, materials, tools, equipment and incidentals for doing all work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

2.25 SYNTHETIC TURF

- A. Synthetic Turf shall include but not be limited to synthetic turf, nailers, base courses, shock pad, and shall include all labor, materials, tools, equipment and incidentals and for doing all work, complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.26 7' HT ORNAMENTAL METAL FENCE

- A. 7' HT Ornamental Metal Fence shall include but not be limited to all labor, materials, tools, equipment and incidentals and for doing all fencing work, complete in place as shown on the

plans, as specified in the Standard Specifications and these Special Provisions.

2.27 RECYCLED WATER IRRIGATION SYSTEM

- A. Recycled Water Irrigation System shall include but not be limited to Gate Valves, Remote Control Valves, Spray Heads, Shrub Bubblers, Irrigation Sleeves, Irrigation lateral lines, Irrigation Mainline, Irrigation Conduit and Low Voltage Wires, and all Irrigation items required for a complete, automated and operational irrigation system including but not limited to all clean-up, inspections, approvals, adjustments, enclosure, testing, record contract drawings, replacements, concrete footings, thrust blocks, fittings, pull rope, tracer wire, pea gravel, bricks, electrical boxes, valve boxes, risers, wye strainers, filters, waterproof connections, replacement of unsatisfactory materials, trenching, stockpiling, excavation, backfill materials, refilling trenches, compaction, and warranty, and shall include all labor, materials, tools, equipment and incidentals and for doing all planting work involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.28 MISCELLANEOUS IRRIGATION REPAIR

- A. Miscellaneous Irrigation Repair shall include but not be limited to the replacement of irrigation mainline, lateral line, valves, fittings, spray and rotor heads and all other irrigation equipment damaged by storm and sanitary sewer rerouting work, and shall include all labor, materials, tools, equipment and incidentals and for doing all planting work involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.29 LANDSCAPING

- A. Landscaping shall include but not be limited to 24" Box Trees, 14' BTH palm Trees, Anchoring Systems, Drainage, Landscape Fabric, 5 Gallon Shrubs, Bark Mulch, Turf Sod, Root Control Barriers, and Soil Amendment and preparation, and shall include all labor, materials, tools, equipment and incidentals and for doing all planting work involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.30 90 DAY PLANT ESTABLISHMENT PERIOD

- A. Landscape Maintenance shall include but not be limited to all labor, materials, tools, equipment and incidentals and for doing all work to maintain and establish new planting, turf and trees for a duration of 90 days, complete in place as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.31 STORM DRAINAGE

- A. Storm Drainage shall include but not be limited to area drains, slot drains, yard drains, trench drains, 4-inch storm drain pipes, 6-inch storm drain pipes, drop inlet filters, 15-inch RCP storm drain, adjusting pipe connection to existing storm drain inlet and all excavation, trenching, shoring, pipe installation to grade, filter fabric, bedding, backfill, and shall include all labor, materials, tools, equipment and incidentals and for doing all work involved as shown on the plans, as specified in the Standard Specifications and these Special Provisions.

2.32 SANITARY SEWER SYSTEM

- A. SANITARY SEWER MANHOLE: Sanitary Sewer Manhole shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals for installing the manhole

complete in place, including excavation, disposal of unsuitable materials, aggregate base, backfill, dewatering (if needed), steel reinforcement, excavation, removal of excavated material and off-site disposal, connection to sanitary sewer pipes, grouting around pipes, protection of utilities, shoring per OSHA requirements (if needed), dealing with existing flows, compaction, covers and lids, pavements restoration, and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

- B. 8-INCH SANITARY SEWER PIPE (PVC): 8-Inch Sanitary Sewer Pipe (PVC) shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals to furnish and install the pipe, complete in place, including excavation, disposal of unsuitable materials, aggregate base, shoring, dewatering (if needed), bedding, backfill, grout, connecting new pipe to existing or new facilities, compaction, pavement restoration, and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- C. 4-INCH SANITARY SEWER PIPE (PVC): 4-Inch Sanitary Sewer Pipe (PVC) shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals to furnish and install the pipe, complete in place, including excavation, disposal of unsuitable materials, aggregate base, shoring, dewatering (if needed), bedding, backfill, grout, connecting new pipe to existing or new facilities, compaction, pavement restoration, and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.
- D. ADJUST PIPE CONNECTION TO EXISTING SANITARY SEWER MANHOLE: Adjust Pipe Connection to Existing Sanitary Sewer Manhole shall include but not be limited to furnishing all labor, materials, tools, equipment and incidentals to furnish and install the pipe, complete in place, including excavation, disposal of unsuitable materials, aggregate base, shoring, dewatering (if needed), bedding, backfill, grout, connecting new pipe to existing or new facilities, compaction, pavement restoration, and other work involved as shown on the plans, as specified in the Standard Specifications, and as shown in these Special Provisions.

PART 3 - PAYMENT

- A. Payment: Full compensation for all work items listed above will be paid for as a single lump sum and no additional compensation will be allowed therefore.

END OF SECTION 01 22 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Construction Documents and general provisions of the Agreement Between Owner and Construction Manager and consultant and the Guaranteed Maximum Price (GMP) Amendment, including Division 00 General Conditions of the Contract for Construction – consultant Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for equals and substitutions made after award of the Contract. Formal requests from the Interior Contractor/Vendor or substitution of construction methods, products, materials or finishes in place of those specified will be considered by the Consultant only in accordance to the procedure herein.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 33 00 "Submittal Procedures - specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.03 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
 - 1. *Equals or Substitutions General:* Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Construction Manager after award of the Contract.

1.04 SUBMITTALS

- A. Equals and Substitution Request Submittals

The Owner/Consultant will consider requests for equals or substitutions if the information on all materials is consistent with the information herein. After the Construction Manager's Subcontractor contract award, substitutions will be considered for materials or systems specified that are no longer available. It will not be considered if the product was not purchased in a reasonable time after award. The Construction Manager shall submit all equal and substitutions requests in writing to the Owner/Owner's Representative.

- 1. The Construction Manager is required to prepare and submit three (3) copies of the required data for the first manufacturer listed or procedure listed in the specifications section with reference to all of the following areas: the substance and function

considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating performance, LEED® compliance and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the required data for the proposed Equal or Substitution. This will enable the Owner and Architect to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
3. Provide complete documentation showing compliance with the requirements for equals or substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed Equal or Substitution.
- B. A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
- C. Product Data, including Shop Drawings, and descriptions of products and fabrication and installation procedures.
- D. Use of proposed substitutions will not be an infringement on any copyright, patent or trademark.
- E. Samples, where applicable or requested.
- F. A statement indicating the effect on the Construction Manager's Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.
- G. Cost information, broken down, including a proposal of the net change, if any in the Guaranteed Maximum Price (GMP).
- H. The Construction Manager's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
- I. The Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.

1.05 CONSULTANT'S/ARCHITECT'S ACTION

A. If necessary, the Consultant/Architect will request additional information or documentation for evaluation within **seven (7)** Calendar Days of receipt of the original request for equal or substitution request. The Consultant/Architect will notify the Owner/Owner's Representative of recommended acceptance or rejection of the proposed equal or substitution, within **fourteen (14)** days of receipt of the request, or **seven (7)** days of receipt of additional information or documentation, whichever is later. The Owner/Owner's

Representative will give final acceptance or rejection by the Owner not less than **seven (7)** days after notification.

1. Any request deemed an "Equal" and accepted by the Owner/ Owner's Representative, Architect, Owner, and Agency will result in written notification to the Construction Manager and will not be in the form of a change order for an "Equal".
2. Any request deemed a "Substitution" and rejected or approved by Owner/Owner's Representative, Architect, and Owner may result in written notification to the Construction Manager and may be in the form of a change order if the "Substitution" is approved.

PART 2 - PRODUCTS

2.01 EQUAL OR SUBSTITUTIONS

A. Conditions

The Owner/Architect will consider the Consultant's/Construction Manager's request for Equal or Substitution of a product or method of construction when one or more of the following conditions are satisfied, as determined by the Owner/Architect. If the following conditions are not satisfied, the Owner/Architect will return the requests to the Owner's Representative without action except to record noncompliance with these requirements.

1. The proposed request does not require extensive revisions to the Contract Documents.
2. The proposed request is in accordance with the general intent of the Contract Documents.
3. The proposed request is timely, fully documented, and/or properly submitted.
4. The proposed request can be provided within the Contract Time. However, the Owner/Architect will not consider the proposed request if it is a result of the Consultant's/ Construction Manager's failure to pursue the Work promptly or coordinate activities properly.
5. The proposed request will offer the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. However, if the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Consultant/Architect for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution.
6. The proposed request can receive the necessary approvals, in a timely manner, required by governing authorities having Jurisdiction.
 - a. The proposed request can be provided in a manner that is compatible with the Work as certified by the Consultant/Construction Manager.
 - b. The proposed request can be coordinated with the Work as certified by the Construction Manager.
 - c. The proposed request can uphold the warranties required by the Contract Documents as certified by the Consultant/Construction Manager.

- B. The Construction Manager's submission and the Owner's/Architect's review of Submittals, including but not limited to, Samples, Manufacturer's Data, Shop Drawings, or other such items, which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.

END OF SECTION 01 25 00

SECTION 01 30 00
ABNORMAL WEATHER CONDITIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Criteria for identifying, recording, calculating and scheduling work around rain delays.

1.02 RELATED REQUIREMENTS

- A. Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:
 - 1. The General Conditions and Supplementary Conditions of the Contract apply to the work in this section.

1.03 DESCRIPTION

- A. A rain, windstorm, high water or other natural phenomenon which might reasonably have been anticipated from historical records of the general locality shall not be construed as abnormal. It is hereby agreed that all disruptive weather events with an average interval of ten (10) years or more between their occurrence and the occurrence of a similar event of equal or greater magnitude cannot be reasonably anticipated. For the purposes of this contract, weather information and historical data for an area in question shall be assumed to be the same as that measured at the nearest or most applicable record station of the Environmental Data Service of the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.
- B. Information on measuring stations of the National Oceanic and Atmospheric Administration (NOAA) can be found in the "Climatological Data" published by NOAA. This publication may be found in public libraries or contact:

U.S. Department of Commerce
National Climatic Center
Federal Building
Ashville, NC 28801

1.04 DELAYS DUE TO ABNORMAL WEATHER

- A. Weather days will be recorded by the Contractor and forwarded to the Project Manager within five (5) days of occurrence. Each record shall indicate the critical path activity(s) affected. It will be the contractor's duty to perform on unaffected activities whenever possible during weather days.

- B. Weather day delays are calculated by subtracting the 10-year average disruptive weather, as described above, from the actual encountered/report days.
- C. Time extensions may be granted for weather impacts occurring beyond the parameters set forth in this section on critical path activities only. The Contractor is to provide schedule data to the City Engineer illustrating the critical path impact. There shall be no increase in the contract sum due to time extensions granted for weather delays.

PART 2 - PRODUCTS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

END OF SECTION 01 30 00

SECTION 01 31 13
GENERAL COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Information (RFI's).
- B. Related Sections:
 - 1. Section 01 31 19 – Project Meetings
 - 2. Section 01 33 00 - Submittals

1.03 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.04 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Coordinate structural, mechanical, and electrical elements prior to installation. All penetrations of structural elements must first receive approval of Engineer. Rerouting of ductwork, piping, or conduit caused by failure to coordinate beforehand is the responsibility of the affected subcontractor and will not be considered justification for additional cost.
 - 2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 4. Make adequate provisions to accommodate items scheduled for later installation.

5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
 6. The manner in which the Specifications are divided into Divisions and Sections is not intended to indicate division of work between trades nor indicate trade union or jurisdictional agreements.
 - a. Assign and subcontract construction activities, and employ workers in a manner that will not risk jurisdictional disputes that could result in conflicts, delays, claims, or losses.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-installation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.05 SUPERVISION

- A. Contractor is solely responsible for construction means, methods, techniques, sequences, and procedures for performing all Work.

1.06 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable.
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, plumbing, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - d. Indicate key plan, north arrow, and sufficient grid lines to provide cross reference to contract Drawings.
2. Sheet Size: At least 8-1/2 x 11-inches, but no larger than 30 x 40-inches.
 - a. Provide title block on each sheet with locations for signatures from all subcontractors involved. Include statement that each subcontractor has reviewed coordination drawings in detail and coordinated work of their respective trade.
3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

- B. Key Personnel Names: At the pre-construction meeting, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.07 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
1. Include special personnel required for coordination of operations with other contractors.

1.08 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site, unless otherwise indicated. Construction Manager will:
1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within four working days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule a preconstruction conference before starting construction.
1. Attendees: Authorized representatives of Owner, Construction Manager, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers, representatives of state agencies having jurisdiction and other concerned parties shall

attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including but not limited to the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFI's.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
3. Minutes: Record and distribute meeting minutes.

C. Pre-installation Conferences: Contractor shall conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer and Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related RFI's.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.

- g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review schedule for next period.
 - c. Review present and future needs of each entity present, including the following:

- d. Interface requirements.
 - e. Sequence of operations.
 - f. Status of submittals.
 - g. Deliveries.
 - h. Off-site fabrication.
 - i. Access.
 - j. Site utilization.
 - k. Temporary facilities and controls.
 - l. Work hours.
 - m. Hazards and risks.
 - n. Progress cleaning.
 - o. Quality and work standards.
 - p. Status of correction of deficient work items.
 - q. Field observations.
 - r. RFI's.
 - s. Status of proposal requests.
 - t. Pending changes.
 - u. Status of Change Orders.
 - v. Pending claims and disputes.
 - w. Documentation of information for payment requests.
- 3. Minutes: Record the meeting minutes.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.09 REQUESTS FOR INFORMATION (RFI'S)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI to the appropriate member of the Project Design Team.
 - 1. RFI's shall originate with the Contractor. RFI's submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of RFI: Include a detailed, legible description of item needing interpretation or clarification, and the following:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Engineer.
 - 5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other supplementary information necessary to fully describe items needing interpretation.
 12. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
 13. Attachments shall be in Adobe Acrobat PDF format on EADOC.
- C. Engineer's and Construction Manager's Action: Engineer and Construction Manager will review each RFI, determine action required, and return it. Allow five (5) working days for Engineer's response for each RFI. RFI's received after 1:00 P.M. will be considered as received the following working day.
1. No extension of Contract Time will be authorized due to Contractor's failure to allow sufficient time for Engineer's RFI review.
 2. The following RFI's will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFI's or RFI's with numerous errors.
 3. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.
- D. On receipt of Engineer's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer and Construction Manager within five working days if Contractor disagrees with response.

END OF SECTION 01 31 13

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Criteria for Project meetings to be held both before and during construction.

1.02 PRECONSTRUCTION CONFERENCE

- A. A Preconstruction Conference to discuss Project Work will be held at a time and location designated by the City Engineer.
- B. Attendance: City Engineer, Architect/Engineer, Contractors, Inspector, and representatives of Contractor's major subcontractors. The purpose of this conference is to discuss the Project in general, including scheduling of Work, and to answer questions that may arise. Unless followed up in writing, verbal authorizations or instructions by anyone present shall not be binding.

1.03 PROGRESS MEETINGS

- A. At a time designated by City Engineer, Weekly Progress Meetings will be held at location to be determined.
- B. Attendance: City Engineer, Architect/Engineer, Contractors, Inspector, major subcontractors, Project Manager, Architect, and Suppliers as deemed necessary by the Project Manager.
- C. Contractor will be responsible for notifying subcontractors and suppliers of their required attendance. The purpose of these meetings is to discuss schedule, progress, coordination, submittals, and job related problems.
- D. Verbal authorizations or acknowledgments by anyone present will not be binding unless followed up in writing by authorized representatives of the Owner or Contractor.
- E. The Project Manager will conduct the meetings, prepare and distribute meeting notes.

END OF SECTION 01 31 19

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General:
 - 1. Section Addresses:
 - a. Mechanics and administration of the submittal process for shop drawings, operation and maintenance manuals, and miscellaneous submittal items.

1.02 RELATED REQUIREMENTS

- A. Related Sections include but are not necessarily limited to:
 - 1. Special Provisions, Proposal, and Contract.
 - 2. Division 1 – General Requirements.
 - 3. Sections in Division 2 through 16 identifying required submittals.

1.03 DEFINITIONS

- A. Shop Drawings:
 - 1. See General Conditions
 - 2. Product data and samples are Shop Drawing information.
- B. Miscellaneous Submittals:
 - 1. Submittals other than Shop Drawings:
 - 2. Representative types of miscellaneous submittal items include but are not limited to:
 - a. Construction schedule.
 - b. Concrete, soil compaction, and pressure test reports.
 - c. Installed equipment and systems performance test reports.
 - d. Manufacturer's installation certification letters.
 - e. Instrumentation and control commissioning reports.
 - f. Warranties.
 - g. Service agreements.
 - h. Construction photographs.

1.04 TRANSMITTALS

- A. Shop Drawings and Operation and Maintenance Manuals:

1. Transmit all submittals to City Engineer.
2. Utilize two copies of attached Exhibit "A" to transmit all shop drawings, product, data and samples.
3. Utilize two copies of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.
4. All transmittals must be from Contractor and bear his approval stamp. Transmittals will not be received from or returned to subcontractors.
 - a. Shop drawing transmittal stamp shall read (Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval. Transmittals will not be received from or returned to subcontractors.
 - b. Operation and Maintenance Manual transmittal stamp may be Contractor's standard approval stamp.
5. Provide submittal information defining specific equipment or materials utilized on the project. Generalized product information not clearly defining specific equipment or materials to be provided will be rejected.
6. Calculations required in individual specification sections will be received for information purposes only and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
7. Calculations required in individual specification sections are required as For-Information Only-For-Future-Use submittals. Calculations and other submittals identified as For-Information-Only-For Future-Use submittals shall be transmitted directly to the Engineer at:
8. Submittal schedule:
 - a. Schedule of shop drawings and submittals:
 - 1) Submitted and approved within 20 days of receipt of Notice to Proceed.
 - 2) Submittal review comments will be provided within 10 days of receipt of complete submittal.
 - b. Shop drawings:
 - 1) Submittal and approval prior to 50 percent completion.
 - c. Operation and Maintenance Manuals and Equipment Record Sheets:
 - 1) Initial submittal within 60 days after date shop drawings are approved.

B. Miscellaneous Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual specification section.
3. Transmit to:
4. Provide copy of letter of transmittal to Owner's Resident Project Representative.
 - a. Exception for concrete, soils compaction and pressure test reports.
 - 1) Transmit one copy to Resident Project Engineer.
 - 2) Transmit one copy to location and individual indicated above for other miscellaneous submittals.

1.05 PREPARATION OF SUBMITTALS

A. Packaging of Submittals

1. Submittals for work items shall be fully complete and inclusive of all work within the specification section submitted as a single package with a detailed table of contents. Single submittals of miscellaneous general items will be returned for packaging within the Section Submittal.

B. Shop Drawings:

1. Number transmittals consecutively beginning with 1.
2. Number transmittals of resubmitted items with the original root number and a suffix letter starting with "A" on a new transmittal form.
3. Restrict each letter of transmittal to only one Specification Section or portion thereof.
4. Provide breakout of each transmittal contents on transmittal form. Each component thus defined will receive specific action by the Engineer. Define manufacturer, item, Contract Document tag number, and Constrict Drawings/Specification reference.
5. Do not change the scope of any resubmittal from the original transmittal scope. If some components of the original or previous resubmittal transmittal received "A" or "B" Action and others did not, list the "A" or "B" Action components in subsequent resubmittal packages and indicate "A" or "B" Action code previously received on the transmittal form. With prior approval of the Engineer, components of an original submittal or prior resubmittal that have not received an "A" or "B" Action may be withheld from a resubmittal. Such components shall be listed on the resubmittal transmittal form and indicated as "Outstanding – To Be Resubmitted at a Late Date".
6. Contractor shall not use red color for marks on transmittals. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible. Outline Contractor marks on reproducible transparencies with a rectangular box.
7. Transmittal contents:
 - a. Coordinate and identify shop drawing contents so that all items can be easily verified by the Engineer.
 - b. Identify equipment or material use, tag number, drawing detail, references, weight, and other project specific information.
 - c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
 - d. Submit items like equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8 ½ x 11 pages. Indicate exact item or model and all options proposed.
 - e. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data. Arrange data and performance information in form at similar to that provided in Contract Documents. Provide, at minimum, the detail provided in the contract Documents.
 - f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

C. Samples:

1. Identification:

- a. Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, specification section or drawing detail reference, color, range, texture, finish and other pertinent data.
 - b. If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
2. Include application specific brochures, and installation instructions.
 3. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
 4. Resubmit samples of rejected items.

1.06 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
 - a. A – FURNISH AS SUBMITTED.
 - b. B – FURNISH AS NOTED (BY ENGINEER).
 - c. C – REVISE AND RESUBMIT.
 - d. D – REJECTED.
 - e. E – ENGINEER'S REVIEW NOT REQUIRED.
2. Transmittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified in Paragraph 1.03-A.4.a., will not be reviewed for technical content and will be returned without any action.
3. Transmittals returned with Action "A" or "B" are considered ready for fabrication and installation. If for any reason a transmittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
4. Transmittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
 - a. The portion or the transmittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference). One copy or the one transparency of the "C" or "D" drawings will be marked up and returned to the Contractor. Correct and resubmit items so marked.
 - b. Items marked "A" or "B" will be fully distributed.
 - c. If a portion of the items or system proposed are acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action. This is at the sole discretion of the Engineer. In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package". Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
5. Failure to include any specific information specified under the submittal paragraphs of the

specifications will result in the transmittal being returned to the Contractor with “C” or “D” Action.

6. In addition to calculations stamped and returned “E. Engineer’s Review Not Required,” other transmittals such as submittals which the Engineer considers as “Not Required,” submittal information which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed not received “A” or “B” Action in a prior transmittal, will be returned with action “E. Engineer’s Review Not Required.”
7. Samples may be retained for comparison purposes. Remove samples when directed. Include in bid all costs of furnishing and removing samples.
8. Approved samples submitted or constructed, constitute criteria for judging completed work. Finished work or items not equal to samples will be rejected.

END OF SECTION 01 33 00

SECTION 01 50 00

TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Comply with requirements of the Storm Water Pollution Control Plan (SWPPP) and Construction General Permit prepared for this project.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Potable Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Potable water shall not be used for dust control, grading, compaction or paving operations.
- F. Recycled Water Service from Existing System: Water from Owner's existing reclaimed water system is available for use without metering and without payment of use charges for dust control, grading, compaction and paving operations. Provide connections and extensions of services as required for construction operations.

- G. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
- D. Dust Control Plan: Submit plan for dust control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Service will be provided by Owner.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Owner will provide temporary toilets, wash facilities, and drinking water for use of construction personnel.
 - 1. Toilets: Use of Owner's existing toilet facilities will not be permitted.
- E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering adjacent properties.
- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- B. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
- C. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
- D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 01 10 00 "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with Construction General Permit and SWPPP and requirements specified in Section 31 10 00 "Site Clearing."
- D. Temporary Construction Fence: Provide temporary 6' ht. chain link construction fencing with adequate signing and warning. Comply with requirements of authorities having jurisdiction.
- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements.

END OF SECTION 01 50 00

SECTION 01 56 39
TREE PRESERVATION AND PRUNING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included: Furnish all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified for the protection, preservation and/or repair of trees, including care, pruning, and trimming (limbs and roots) as required to construct improvements.

- B. Contractor shall protect from damage all existing vegetation determined by the City to remain on the project site and also on adjacent property (for trees overhanging the project site). Contractor shall be responsible for the repair any damage, including that to the adjacent property resulting from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly and according to the City directions, the City may have the necessary work performed and charge the cost to Contractor.
 - 1. Tree and Plant Protection includes, but is not limited to the following:
 - a. The protection of the above and below-ground portions of trees and plants including roots, trunks, branches and foliage. Protection of roots includes reduction and/or prevention of soil compaction caused by vehicles, equipment, materials or foot traffic.
 - b. Protective Fencing surrounding the Tree Protection Zone around the tree or group of trees.
 - c. Pre-work Clearance Pruning for demolition and construction
 - d. Organic mulch placed in tree protection zones
 - e. Irrigation of trees before and during demolition and construction.
 - f. Dealing with protection and preservation of tree roots relative to soil grubbing, grading, structure or pavement removal, excavations, etc.
 - g. Ongoing updating and consultation with the City Representative regarding site work and potential tree impacts

- C. Related Work:
 - 1. Section 02020/31 10 00 – Clearing, Grubbing and Misc. Demolition
 - 2. Section 02900/32 90 00 – Landscape Planting
 - 3. Section 02300/31 00 00 – Earth Works

1.02 RELATED DOCUMENTS

- A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

B. References:

1. Arboriculture: The care of trees and shrubs by Dr. Richard Harris
2. Best Management Practices, Tree Pruning. 2008. International Society of Arboriculture, PO Box 3129, Champaign, IL 61826-3129. 217-355-9411
3. ANSI A300 Pruning Standards. 2008 Edition. Ibid. (Covers tree care methodology).
4. ANSI Z133.1 Safety Requirements for Arboricultural Operations. 2006 Edition. Ibid. (Covers safety).

1.03 DEFINITIONS

1. **Certified Arborist**: An Arborist certified through the ISA (International Society of Arboriculture) after passing a test demonstrating basic knowledge about urban trees and their management, fulfilling an ongoing continuing education requirement and paying regularly scheduled certification fees.
2. **Dripline (tree)**: The area under the total branch spread of the tree, all around the tree.
3. **Existing tree**: The trees existing on property prior to any demolition or construction for a project.
4. **Neighboring tree**: Existing trees on adjacent private property not owned by the City, but the dripline of which overhangs the City property
5. **Qualified Tree Service**: A tree service with a supervising arborist who has the minimum certification level of ISA (International Society of Arboriculture) Certified Arborist, in a supervisory position on the job site during execution of the tree work. The tree service shall adhere to the most current of the following arboricultural industry tree care standards.
6. **Tree**: a woody perennial plant usually having one dominant trunk and a mature height greater than 15 feet. Multiple-trunk trees have more than one trunk.
7. **Tree Protection Zone (TPZ)**: The area inside the Tree Protection Fencing on a City project, containing the tree or tree trunks and below some or the entire canopy of the tree or beyond the canopy. The TPZ and Tree Protection Fencing remain in place prior to any work on site (including demolition) until the construction project is fully completed.
8. **Tree Service**: A company that performs tree pruning and tree removals as their main business.

1.04 QUALITY ASSURANCE

- A. All tree protection, preservation and pruning performed shall be executed by a Qualified Tree Service company having, in full-time employment, an Arborist certified by the International Society of Arboriculture (ISA). Certification must be verified. The Arborist must be directly responsible for decisions made and should visit the work sites daily when trimming of tree limbs and roots are to be performed.
- B. Pruning shall be performed to the standards of the International Society of Arborists Pruning guidelines, and to ANSI A-300.
- C. Tree pruning shall not occur without first securing a pruning permit. Permit applications shall be submitted to City.

1.05 SUBMITTALS

- A. Arborist certification
- B. Tree Pruning Schedule (provided by Qualified Tree Service Contractor): Written schedule detailing scope and extent of pruning of trees to remain and that interfere with or are affected by demolition or construction.

1.06 TAGGING OF TREES TO BE PRESERVED

- A. All preserved trees shall be flagged with a distinctive colored ribbon prior to Tree removal. After flagging and prior to commencement of any work, the Contractor shall notify the City who will verify that the correct trees are flagged.

1.07 JOB CONDITIONS

- A. The Contractor will be held responsible for any damage to trees or other plants, which are to remain during construction, including limb or branch breakage, tearing of bark along trunk or excessive root damage. Large roots greater than 3" in diameter and less than 12" below ground level shall not be cut without the City's approval.
- B. The following practices are prohibited within Tree Protection Zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Placement of outhouses
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Equipment wash down.
 - 8. Grubbing of soil surface to remove organic matter.
 - 9. Disposal of chemicals, petroleum products, or other detrimental substances.
 - 10. Excavation, grading or other soil disturbance unless otherwise indicated.
 - 11. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated on plans.

PART 2 - PRODUCTS

2.01 TREE PROTECTION-ZONE FENCING

Fencing fixed in position and meeting the following requirements:

- A. Snow Fencing Protection-Zone Fencing: Orange plastic fencing, 4' height with steel stake posts with tie wires, hog ring ties, and other accessories for a complete fence system.

2.02 MULCH

- A. Per planting specifications

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. If at any time the Contractor judges that the protection of a tree designated to be saved is incompatible with work required, or if operations necessary threaten the health or structural stability of a tree, notify immediately the City and do no further work affecting the tree until a written agreement is reached concerning acceptable procedures.
- B. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion-and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree protection zones.
- C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- D. Contractor shall install 8 or 9 inch diameter straw wattling roll on the uphill side of the protective fence to divert runoff from the construction site to the protected trees. The wattle shall be maintained until protective fence is removed from the project site.
- E. Under no circumstances shall the Contractor remove existing trees that are indicated not to be removed.
- F. Tree removal may not damage existing trees or vegetation to remain; consult with Owner's Representative regarding any conflicts.

3.02 TREE PROTECTION ZONES

- A. Protection-Zone Fencing: Install Tree Protection Fencing along edges of Tree Protection Zones in a manner that will prevent people from easily entering protected area except for arborist inspection and tree maintenance. An 18-inch wide gap for arborist access and tree maintenance will be provided in each fenced off area.
 - 1. Orange Snow Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to the City.
 - 3. Access Gap in Fencing: Provide an 18-inch wide gap, with a standard steel post on each side of the gap, overlap fence fabric to close gap.
- B. Contractor shall repair or replace protected trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations at no additional cost to contract or

City. The City Representative shall specify any repair work or replacement value for damaged trees and landscaping.

- C. Maintain Tree Protection Fencing in good condition as acceptable to the City Arborist and remove when construction operations are complete and equipment and materials have been removed from the site. At sites where the excavation has taken place near trees to remain, and many living roots remain exposed to the air, the Contractor shall cover the exposed roots within 2 hours with sand, soil, moist burlap or other means acceptable to the City.
- D. Construction materials, debris, and supplies shall not be stored within the drip line or protective fencing area under any tree.
- E. Vehicles shall not be parked within the drip line or protective fencing area.
- F. Woodchips or another cushioning surface material approved by the City shall be placed over areas where roots are present and construction traffic occurs.

3.03 EXCAVATION

- A. General: Hand or air spade excavate at edge of Tree Protection Zones for grading, trenches and other soil disturbance adjacent to existing trees.
- B. No rototilling or other soil disturbance shall take place within Tree Protection Zones, before, during, or after demolition or construction, unless designated within construction documents.
- C. Trenching near Trees: Where utility trenches are required within or adjacent to Tree Protection Zones, air spade or hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut *large* (e.g. 2 inches in diameter or greater) roots; cut only smaller roots that interfere with installation of utilities.
- D. Open trenches are not to be routed beneath the dripline of trees that are to be preserved unless this is impossible to avoid; in which case damage may be reduced by careful placement by air spading or hand-digging of trenches to avoid large roots by tunneling under rather than cutting roots greater than 2 inches or greater in diameter.

3.04 TREE PRUNING

- A. Remove branches that are in the path of temporary and permanent construction, or within the work zone margin beyond that construction. Where trees are concerned, minimize the work zone margin to the minimum possible to accomplish demolition or construction work. Any pruning will be completed by a Qualified Tree Service, but it is the contractor's responsibility to notify the [City](#) of any pruning that is necessary.
- B. Tree pruning shall be performed to balance the crown and eliminate hazards. The main work performed shall be to reduce the sail effect through thinning, reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs and sucker growth. Limbs shall be pruned back to an appropriate lateral branch.

- C. All final cuts shall be made at the outer edge of the branch collar. The pruning work shall be performed in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards
- D. The Contractor shall be responsible for the preservation of all public and private property. Pruning includes the cutting of limbs, cleanup, removal and disposal of cuttings and debris. Elm logs must be properly disposed of per State Quarantine. Work shall be performed by a two-person crew with one climber, one ground person, a dumping chipper truck and chipper, and any other necessary saws, lines, tools and safety equipment. The work area shall have appropriate cones and signs for safe pedestrian and vehicle traffic.

3.05 ROOT PRUNING

- A. Tree roots greater than 3” in diameter and less than 12” below ground level shall not be cut without approval of the City Representative.
- B. Roots shall be cut clearly, as far from the trunk of the tree as possible. Root pruning shall be to a depth of 18”.
- C. Root pruning shall be performed using a Vermeer Root Cutting Machine. Alternate equipment or techniques must be approved by the City Representative.
- D. Root pruning shall be completed prior to base or subgrade preparation, or to any excavation adjacent to the tree.
- E. Root Pruning
 - 1. Prior to root cutting air spade or hand dig a trench along the edge of the excavation facing the protected tree(s), to the depth of the excavation. The trench must be at least 12 inches wide. Cut exposed roots that need to be removed cleanly back to the trench wall with sharp pruning tools. Do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots. Heavy equipment may be used to continue soil work but the equipment must not contact the roots that have been cut at the edge of the trench, or any soil or roots on the tree-side of the trench.
 - 2. Exposed roots must be covered with 2 layers of natural burlap or organic mulch that is kept moist until backfilled. The exposed trench wall must be sprayed with water and thoroughly moistened with water prior to placement of burlap.
 - 3. Backfill as soon as possible according to requirements in Section 02300/31 00 00 -- Earth Work. Wet the backfill soil thoroughly as it is placed in the trench.

3.06 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off City's property.

END SECTION 01 56 39

SECTION 01 57 19

ENVIRONMENTAL STEWARDHIP

PART 2 - PART 1 GENERAL

2.01 SECTION INCLUDES

- A. CONTRACTOR shall provide environmental controls consistent with regulatory requirements throughout the duration of the PROJECT.
- B. Full compensation for required compliance and cooperation is considered subsidiary to other items of WORK, and no additional compensation will be allowed.

2.02 SUBMITTALS

- A. Dust control agents other than water must be approved by ENGINEER prior to use.
- B. Plan for water control per section 01 57 23 prior to beginning any WORK.
- C. Stormwater quality management measures, Stormwater Management Plan (SWPPP) and methods proposed by CONTRACTOR must be in conformance with all applicable permits and approved by ENGINEER prior to installation and prior to moving onto the construction site.
 - 1. Submit the initial phase SWPPP at the preconstruction conference. Submit plans for future phases of construction a minimum of 28 days before start of that construction phase to allow review and resubmittal, if necessary.
- D. Prepare schedules to implement stormwater management features, including but not limited to erosion and sediment control work, and submit for acceptance at preconstruction conference.
 - 1. Schedules shall incorporate construction activities, haul roads, borrow pits, storage and plant sites, and the plan for disposal of waste material.
 - 2. WORK shall not start until the ENGINEER has approved these schedules.

2.03 RELATED SECTIONS

- A. The following is a list of SPECIFICATIONS, which may be related to this section:
 - 1. Section 01 14 19, Use of Site.
 - 2. Section 00 73 00, Supplementary Conditions

3. Section 00 73 00. Supplementary Conditions, Article 90, Permits
4. Section 00 73 94, Special Project Procedures

PART 3 - PART 2 EXECUTION

3.01 DUST CONTROL

- A. CONTRACTOR shall minimize dust from construction operations.
- B. During the performance of the WORK, whether on right-of-way provided by OWNER or elsewhere, CONTRACTOR shall furnish labor, equipment, and materials to control dust at all times, including evenings, holidays, and weekends.
- C. CONTRACTOR shall be liable for any damage resulting from dust originating from CONTRACTOR's operations.

3.02 HOUSEKEEPING

- A. CONTRACTOR shall keep the PROJECT neat, orderly, and in a safe condition at all times, and shall store and use equipment, tools, and materials in a manner that does not present a hazard.
- B. CONTRACTOR shall provide on-site containers for collection of rubbish and construction waste and dispose of it at frequent intervals during the progress of WORK, and whenever directed by ENGINEER.
- C. CONTRACTOR shall be responsible for conforming will all elements of the SWMP and other CDPHE permits, including any requirements addressing storage and disposal of potential stormwater pollutants.

3.03 DISPOSAL

- A. CONTRACTOR shall legally dispose of waste materials and materials determined by ENGINEER to be waste in an approved disposal site in a manner meeting all federal, state, local, and PROJECT regulations.
- B. CONTRACTOR shall not bury waste unless authorized by the OWNER and the ENGINEER.
- C. All costs related to disposal, including but not limited to dump fees, permits, etc., will be the responsibility of CONTRACTOR.
- D. Excess excavation shall become the property of CONTRACTOR (unless otherwise specified) and be legally disposed of by CONTRACTOR outside the limits of construction in an approved disposal site.

- E. Excess excavated material suitable for backfill shall not be disposed of until all backfill operations are complete.
- F. CONTRACTOR shall immediately inform ENGINEER of any hazardous materials encountered during construction and legally dispose of such hazardous materials at an approved disposal site.
- G. Burning will not be permitted.

3.04 WATER CONTROL

- A. Periodic Flooding:
 - 1. The PROJECT may be subject to periodic flooding as a result of rainfall and snowmelt, reservoir or pond releases, flows from adjacent developed areas and stormwater pipes, and groundwater flows from saturated soils or other groundwater sources.
- B. Until final acceptance of the PROJECT by OWNER, CONTRACTOR shall have the charge and care thereof and shall take every precaution against injury or damage to any part thereof from any cause, including surface and subsurface water, whether arising from the execution or from non-execution of the WORK.
- C. CONTRACTOR shall rebuild, repair, restore, and make good injuries or damages to any portion of the WORK because of causes beyond the control of and without the fault of negligence of CONTRACTOR, including but not restricted to high water, floods, or acts of God, of the public enemy, or of governmental authorities.
- D. CONTRACTOR shall be responsible for the PROJECT and shall take such precautions as may be necessary to construct the PROJECT in a dry condition and provide for drainage, dewatering, and control of surface and subsurface water and shall erect any necessary temporary structures or other facilities at CONTRACTOR's expense.
- E. CONTRACTOR is advised that the WORK may occur in a river or drainage channel subject to intermittent and extensive runoff conditions such that, unless the construction area is properly protected, localized flooding and extensive soil erosion may occur.
- F. OWNER, at OWNER's option, may require CONTRACTOR to update the water control plan.
- G. CONTRACTOR, at CONTRACTOR's expense, shall furnish necessary equipment and materials required to control surface and subsurface water in all areas from start of WORK through the completion of the PROJECT. Applicable permits related to specific controls shall be obtained by CONTRACTOR and all associated fees shall be borne by the CONTRACTOR.
- H. CONTRACTOR is responsible for furnishing; transporting; and installing all materials and equipment, well points, pumping, channelization, diversion, damming, or other means of controlling surface water, groundwater, runoff from other drainage tributaries, and pipe

effluent as necessary to complete all of the WORK in accordance with the CONTRACT DOCUMENTS.

3.05 WATER QUALITY CONTROL

- A. CONTRACTOR shall comply with the “Clean Water Act”, regulations promulgated, certifications issued, and the construction requirements listed below.
 - 1. In the event of conflicts between Federal and State water quality control laws, rules, or regulations, the more restrictive laws, rules, or regulations shall apply.
- B. This WORK shall consist of measures needed for the purpose of minimizing water pollution, erosion, and sedimentation during the length of the construction activity.
- C. This SPECIFICATION shall be followed to minimize the pollution of any watercourse, wetland, or water impoundment area.
- D. Stormwater Management Plan (SWMP):
 - 1. CONTRACTOR shall submit SWMP for review by OWNER in accordance with the submittal requirements defined in these SPECIFICATIONS. Adjustments to the approved plan may be required by OWNER based on actual construction operations. Changes to the plan shall only be made with the written approval of the OWNER.
 - 2. The SWMP may include measures for the control of erosion and sedimentation, and measures for stormwater quality management.
 - 3. CONTRACTOR shall take the necessary steps to comply with the intent of OWNER’s SWMP guidance, if it is provided in the DRAWINGS and SPECIFICATIONS, and other applicable standards, permit conditions, and regulations of appropriate agencies.
- E. CONTRACTOR shall construct, operate, maintain, and remove in a safe manner temporary erosion and sediment control features described in OWNER’s SWMP guidance, if it is provided in the DRAWINGS and SPECIFICATIONS.
- F. CONTRACTOR shall conduct the WORK in such a manner to prevent contamination of adjacent watercourses, wetlands, or water impoundment areas.
- G. Diversion or Bypass around Erosion Control Facilities:
 - 1. Any diversion from, or bypass of water around facilities necessary to maintain compliance with the terms and conditions contained in SWMP is prohibited except:
 - a. Where unavoidable to prevent loss of life or severe property damage.
 - b. Where excessive storm drainage or runoff would damage the facilities.
 - 2. If diversion or bypass of water around the facilities occurs, CONTRACTOR shall immediately notify OWNER of the occurrence.

3. CONTRACTOR, at CONTRACTOR's expense, shall repair the breached or bypassed facilities and shall be responsible for the restoration of site drainage to conform to the requirements of the approved SWMP.
- H. If CONTRACTOR installs a portable concrete or asphalt plant, it is CONTRACTOR's responsibility to obtain stormwater discharge and other required permits for such plants.
 - I. CONTRACTOR shall provide design and implementation methods for overall site stormwater quality management to prevent contaminated surface runoff from entering the waters of the State and of erosion and sediment control measures for the purpose of correcting conditions unforeseen during the design of the PROJECT, or for emergency situations that develop during construction.
 - J. CONTRACTOR shall include temporary erosion and sediment control features for construction work outside the right-of-way that is necessary for borrow pits, haul roads, and equipment and material storage sites.
 1. Should the inclusion of these additional work areas cause the PROJECT to be subject to Stormwater Discharge Permit(s), it shall be CONTRACTOR's responsibility to obtain the necessary permit(s).
 - K. CONTRACTOR shall continuously maintain stormwater management features from start of WORK through the completion of the PROJECT, ensuring proper functionality.
 - L. CONTRACTOR is responsible for the removal and storage and/or disposal of accumulated sediment.
 - M. Any construction waste or salvageable material, excavation excess material, fill material, construction equipment, toxins, fuels, lubricants, and other petroleum distillates shall not be stored or stockpiled within fifty (50) feet of the ordinary high water line of any watercourse, wetland, or water impoundment area or other sensitive areas as identified by the ENGINEER.
 - N. Equipment servicing shall occur within ENGINEER approved designated areas.
 - O. Spill prevention and containment measures as proposed by CONTRACTOR and approved by ENGINEER shall be used at all storage sites.

3.06 NOISE CONTROL

- A. Mechanical equipment shall be equipped with the best available mufflers to reduce noise.
- B. CONTRACTOR shall be responsible for obtaining any necessary permits and shall limit noise to the levels established in the permit and in local jurisdiction noise control ordinances, if applicable CONTRACTOR shall perform noise level monitoring as necessary, or as requested by the OWNER, to show that permitted noise levels are not exceeded.

- C. During the performance of the WORK, whether on right-of-way provided by OWNER or elsewhere, CONTRACTOR shall furnish all the labor, equipment, and materials required to reduce the noise nuisance.

END OF SECTION 01 57 19

SECTION 01 57 23
WATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work in this section includes furnishing all labor, equipment and materials necessary for the implementation, maintenance, monitoring, and reporting as required by the CONTRACTOR- provided Storm Water Pollution Prevention Plan (SWPPP) and the Construction General Permit.
- B. OWNER will provide
 - 1. Project SWPPP, prepared and certified by a Qualified SWPPP Developer (QSD)
- C. Contractor shall provide:
 - 1. Qualified SWPPP Practitioner (QSP) to oversee permit compliance during construction.
 - 2. QSD if SWPPP amendments are required
 - 3. Water Pollution Control Manager (WPCM)
- D. Principal items of work include:
 - 1. SWPPP administration and maintenance
 - 2. Training employees and subcontractors in stormwater Best Management Practices (BMPs)
 - 3. Stormwater site inspections
 - 4. Stormwater sampling and numeric analysis if the project is Risk Level 2 or 3.
 - 5. Reporting and recordkeeping
 - 6. Implementing and maintaining BMPs, and removing BMPs when no longer needed.
 - 7. Non-stormwater management and good housekeeping practices
 - 8. Final site cleanup and SWPPP close-out

1.02 REFERENCES

- A. Project SWPPP
- B. Construction General Permit: “Storm Water Discharges Associated with Construction and Land Disturbance Activities,” SWRCB Order No. 2009-0009-DWQ, NPDES General Permit No. CAS000002, with amendments 2010-0014-DWQ and 2012-0006-DWQ
- C. Standard Specifications, State of California, Department of Transportation (Caltrans), 2018 edition
- D. Standard Plans, State of California, Department of Transportation (Caltrans), 2018 edition

- E. Construction Site Best Management Practices Manual (BMP Manual), State of California, Department of Transportation (Caltrans), 2015 edition

1.03 QUALITY ASSURANCE

- A. Qualified SWPPP Practitioner (QSP) shall hold a current QSD or QSP certification from the State of California / CASQA.
- B. Qualified SWPPP Developer (QSD) shall hold a current QSD certification from the State of California / CASQA.
- C. Water Pollution Control Manager (WPCM) shall be appropriately trained and thoroughly familiar with the project SWPPP and Construction General Permit. The WPCM is responsible for overseeing the implementation of the SWPPP on a day-to-day basis. The WPCM shall be an employee of the Contractor and shall be on site regularly.
- D. The WPCM shall educate, direct and enforce compliance with the requirements of the SWPPP by all employees and subcontractors.
- E. All contractor employees, subcontractors, and heavy equipment operators shall attend a pre-construction water pollution control training session conducted by the Contractor's WPCM.

1.04 GENERAL PERFORMANCE REQUIREMENTS

- A. All storm water and non-storm water discharges shall be in compliance with all applicable federal, state, and local requirements.
- B. This Section and the SWPPP outline the contract minimum requirements, and do not relieve the Contractor of his responsibilities for protection of water quality in accordance with all federal, state, and local requirements.
- C. Additional BMPs shall be required if the BMPs which are utilized are not adequately protecting water quality.
- D. The Contractor shall update the Water Pollution Control Drawings to indicate current operations, equipment used, sequence of work, and other aspects of the project.
- E. Contractor and all subcontractors shall be thoroughly familiar with all of the requirements of the SWPPP and Construction General Permit. Contractor is responsible for the performance of subcontractors. Contractor's WPCM shall inspect and monitor all subcontractors' work and storage areas for compliance with this Section.

1.05 FINES AND PENALTIES

- A. Contractor shall pay any fines and be liable for any other penalties that may be imposed by any federal, state, or local regulatory agency for non-compliance with any water quality requirement during the course of work.

- B. Contractor is responsible for implementing any and all BMP corrective measures, at his own expense, as may be directed by the regulatory agencies.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide all temporary and permanent water pollution control measures, equipment and materials as required by this Section and the Construction Drawings.
- B. Materials shall conform to the Caltrans Standard Specifications and Caltrans Standard Plans including Standard Specifications sections:
 - 1. 13-4 Job Site Management
 - 2. 13-5 Temporary Soil Stabilization
 - 3. 13-6 Temporary Sediment Control
 - 4. 13-7 Temporary Tracking Control
 - 5. 13-8 Temporary Active Treatment System
 - 6. 13-9 Temporary Concrete Washouts
 - 7. 13-10 Temporary Linear Sediment Barriers
 - 8. 14-9 Air Quality
 - 9. 14-10 Solid Waste Disposal and Recycling
 - 10. 14-11 Hazardous Waste and Contamination

PART 3 - PART 3 – EXECUTION

3.01 GENERAL

- A. Complete all required information in the SWPPP, to identify the first proposed stage of construction, and to identify personnel involved in WPC work.
- B. Provide documentation for WPCM, employee and subcontractor training, including pre-construction BMP training.
- C. The Contractor's WPCM shall maintain the field-copy SWPPP up-to-date throughout Construction.

3.02 MONITORING, INSPECTIONS AND REPORTING

- A. Contractor's WPCM shall:
 - 1. Conduct daily inspections of adjoining public roadways, material storage areas, and vehicle and equipment areas
- B. Contractor's QSP shall:
 - 1. Monitor the National Weather Service (NWS) forecast on a daily basis.

2. Conduct inspections:
 - a. Within 72 hours prior to predicted rain events to ensure that the site is prepared for the rain event
 - b. At 24-hour intervals during Potential QREs
 - c. Within 48 hours after each QRE
 3. Prepare and submit:
 - a. Weekly BMP Inspection Reports
 - b. Quarterly Non-Stormwater Inspection Reports
 - c. Pre-Rain Event BMP Inspection Reports
 - d. During-rain event Inspection Reports
 - e. Post-Rain Event Inspection Reports
 - f. NAL Exceedance Reports and NEL Violation Reports, if required
 - g. Annual Reports
 - h. Site map and photographs required for the Notice of Termination application.
 4. Develop and implement REAPs if project is Risk Level 2 or 3.
 5. Serve as OWNER's Data Submitter for document submission on the SMARTS website
 6. Generally assist the OWNER in filing reports on the SMARTS website
- C. All reports shall be in a format acceptable to OWNER. Reports shall be submitted within one week of the inspection.
- D. Implement identified corrective actions within 72 hours, unless a later date is authorized
- E. .Notify the OWNER of any site visits by or correspondence received from any federal, state, or local agency, which are related to activities under this Section.

3.03 BEST MANAGEMENT PRACTICES

- A. Implement Best Management Practices as required by Sections 13 and 14 of the Caltrans Standard Specifications.
- B. Work shall comply with the following Caltrans Standard Specifications Sections, as applicable:
 1. 13-4 Job Site Management
 2. 13-5 Temporary Soil Stabilization
 3. 13-6 Temporary Sediment Control
 4. 13-7 Temporary Tracking Control
 5. 13-8 Temporary Active Treatment System
 6. 13-9 Temporary Concrete Washouts
 7. 13-10 Temporary Linear Sediment Barriers
 8. 14-9 Air Quality
 9. 14-10 Solid Waste Disposal and Recycling

10. 14-11 Hazardous Waste and Contamination

- C. Best Management Practices shall be implemented concurrent with the commencement of construction, shall be maintained throughout construction, and shall be removed when no longer required.

3.04 COMPLETION OF WORK

- A. Final site cleanup and stabilization shall be considered complete when all of the following have been achieved:
1. The site will not pose any additional sediment discharge risk than it did prior to the commencement of construction activity;
 2. There is no potential for construction-related storm water pollutants to be discharged into site runoff;
 3. Final stabilization has been reached;
 4. Construction materials and wastes have been disposed of properly;
 5. Post-construction storm water management measures have been installed;
 6. All construction-related equipment, materials and any temporary BMPs no longer needed are removed from the site.
- B. Final stabilization shall be determined by one of the following methods:
1. 70% of the disturbed soil on each individual parcel is uniformly covered by live, actively growing plant matter in contact with the soil;
 2. Alternately, 70% of the disturbed soil on each individual parcel may be uniformly covered in another manner acceptable to the Engineer and the RWQCB.
 3. RUSLE or RUSLE2 method, as outlined in the Permit; computational proof is required;
 4. A custom method. The Contractor shall demonstrate compliance with the final stabilization requirements in the Permit, in some other manner than a or b, above.
 5. At completion of work Contractor and Owner shall inspect the site, and Contractor shall present the currently implemented SWPPP with all backup records to the Owner.

END OF SECTION 01 57 23

Section 01 73 29
Cutting and Patching

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for cutting and patching.
- B. **Related Sections:** The following Sections contain requirements that relate to this Section:
1. Division 01 Section 01 31 00 "General Coordination" for procedures for coordinating cutting and patching with other construction activities.
 2. Division 01 Section 01 35 16 "Alteration Project Procedures" for procedures for coordinating cutting and patching with other construction activities.
 3. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 22, 23, and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 SUBMITTALS

- A. **Cutting and Patching Proposal:** Submit a proposal to the Construction Administrator describing procedures well in advance of the time cutting and patching will be performed and if the Owner's Representative and/or Architect/Engineer requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:
1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
 2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 3. Describe affects to integrity of weather exposed or moisture resistant element.
 4. Describe affects to efficiency, maintenance, or safety of any operational element.
 5. Describe affects to Work of Owner or separate contractor.
 6. List products to be used and firms or entities that will perform Work.
 7. Indicate dates when cutting and patching will be performed.
 8. **Utilities:** List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

9. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations sealed by an Engineer registered in the State of Connecticut showing integration of reinforcement with the original structure.
10. Approval by the Construction Administrator to proceed with cutting and patching does not waive the Architect/Engineer of Record's rights to later require complete removal and replacement of unsatisfactory Work.

1.04 QUALITY ASSURANCE

- A. **Requirements for Structural Work:** Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
 1. Obtain approval from the Architect/Engineer of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Bearing and retaining walls.
 - b. Exterior curtain-wall construction.
 - c. Equipment supports.
 - d. Piping, ductwork, vessels, and equipment.
 - e. Structural systems of special construction in Division 13 Sections.
- B. **Operational Limitations:** Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
 1. Obtain Architect/Engineer's approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Noise and vibration control elements and systems.
 - g. Control systems.
 - h. Communication systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction in Division 13 Sections.
- C. **Visual Requirements:** Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1.05 WARRANTY

- A. **Existing Warranties:** Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.
- B. The Contractor shall install sleeves, inserts and hangers furnished by the trades needing same.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, notify the Construction Administrator and Architect, before proceeding with corrective action.
- B. Openings and chases may not be shown on the Drawings. It is the responsibility of the Contractor to examine the Architectural, Electrical, Heating, Cooling, Ventilating and Plumbing Drawings and to provide chases, channels or openings where needed.
 - 1. After installing Work into openings, channels and/or chases, the Contractor shall close same. If finishes are to be restored, the new Work shall match the original and shall be done by the trade customarily responsible for the particular kind of Work.
- C. The Contractor shall verify dimensions for built-in Work and/or Work adjoining that of other trades before ordering any material or doing any Work. Discrepancies shall be submitted to the Construction Administrator before proceeding with the Work.
- D. See also General Conditions Article 23 “Cutting, Fitting, Patching & Digging”.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Work that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

- D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. **General:** Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
 - 2. DO perform cutting and patching to integrate elements of Work. Provide penetrations of existing surfaces. Provide samples for testing. Seal penetrations through floors, walls, ceilings and roofs, as applicable; restore or preserve fire-rated and smoke-barrier construction. Construction and finishes shall match original Work.
- B. **Cutting:** Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.
 - 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
 - 4. Comply with requirements of applicable Division 32 Sections where cutting and patching requires excavating and backfilling.
 - 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. **Patching:** Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

5. Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.04 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01 73 29

SECTION 01 78 23

OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

- A. Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:
 - 1. General Conditions, including, without limitation, Completion of the Work;
 - 2. Contract Forms and Submittals.

1.02 RELATED REQUIREMENTS

- A. Contractor shall submit under the provisions of Section 00 72 11 – 1.31 Submittal Procedures

1.03 QUALITY ASSURANCE

Contractor shall prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.04 FORMAT

- A. Contractor shall prepare data in the form of an instructional manual entitled “OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS” (“Manual”).
- B. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. When multiple binders are used, Contractor shall correlate data into related consistent groupings.
- C. Cover: Contractor shall identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL & INSTRUCTIONS"; and shall list title of Project and identify subject matter of contents.
- D. Contractor shall arrange content by systems process flow under section numbers and sequence of Table of Contents of the Contract Documents.
- E. Contractor shall provide tabbed fly leaf for each separate Product and system, with typed description of Product and major component parts of equipment.
- F. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.

H. Digital Record: Contractor shall provide a full color PDF with all relevant data duplicated in

digital format.

1.05 CONTENTS, EACH VOLUME

- A. Table of Contents: Contractor shall provide title of Project; names, addresses, and telephone numbers of the Architect, any engineers, sub consultants, Subcontractor(s), and Contractor with name of responsible parties; and schedule of Products and systems, indexed to content of the volume.
- B. For Each Product or System: Contractor shall list names, addresses, and telephone numbers of Subcontractor(s) and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Contractor shall mark each sheet to clearly identify specific Products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Contractor shall supplement Product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Contractor shall not use Project Record Documents as maintenance drawings.
- E. Text: The Contractor shall include any and all information as required to supplement Product data. Contractor shall provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.06 MANUAL FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials, and Finishes: Contractor shall include Product data, with catalog number, size, composition, and color and texture designations. Contractor shall provide information for re-ordering custom manufactured Products.
- B. Instructions for Care and Maintenance: Contractor shall include Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Contractor shall include Product data listing applicable reference standards, chemical composition, and details of installation. Contractor shall provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.
- E. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Each Item of Equipment and Each System: Contractor shall include description of unit or system, and component parts and identify function, normal operating characteristics, and limiting conditions. Contractor shall include performance curves, with engineering data and tests, and complete nomenclature, and commercial number of replaceable parts.

- B. Panel board Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.
- C. Contractor shall include color coded wiring diagrams as installed.
- D. Operating Procedures: Contractor shall include start-up, break-in, and routine normal operating instructions and sequences. Contractor shall include regulation, control, stopping, shut-down, and emergency instructions. Contractor shall include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Contractor shall include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.
- G. Contractor shall include manufacturer's printed operation and maintenance instructions.
- H. Contractor shall include sequence of operation by controls manufacturer.
- I. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Contractor shall provide control diagrams by controls manufacturer as installed.
- K. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).
- O. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.08 SUBMITTAL

- A. Concurrent with the Schedule of Submittals as indicated in the General Conditions, Contractor shall submit to the City for review two (2) copies of a preliminary draft of proposed formats and outlines of the contents of the Manual.
- B. For equipment, or component parts of equipment put into service during construction and to be operated by City, Contractor shall submit draft content for that portion of the Manual within ten (10) days after acceptance of that equipment or component.
- C. On or before the Contractor submits its final application for payment, Contractor shall submit two

(2) copies of a complete Manual in final form. The City will provide comments to Contractor and Contractor must revise the content of the Manual as required by City prior to City's approval of Contractor's final Application for Payment.

- D. Contractor must submit two (2) copies of revised Manual in final form within ten (10) days after receiving City comments. Failure to do so will be a basis for the City withholding funds sufficient to protect itself for Contractor's failure to provide a final Manual to the District

END OF SECTION 01 78 23

SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:
 - 1. General Conditions, including, without limitation, Warranty/Guarantee/Indemnity;
 - 2. Special Conditions; and
 - 3. Operation and Maintenance Data

1.02 RELATED REQUIREMENTS

- A. Contractor shall submit under the provisions of Section 00 72 11 – 1.31 Submittal Procedures

1.03 FORMAT

- A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.
- B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.
- C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier, and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the Product or work item is specified.
- D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractors, suppliers, and/or manufacturers, with name, address, and telephone number of each responsible principals.

1.04 PREPARATION

- A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item or work. Except for items put into use with City permission, Contractor shall leave date of beginning of time of warranty until the date of completion is determined.

- B. Contractor shall verify that warranties are in proper form, contain full information, and are notarized, when required.
- C. Contractor shall co-execute submittals when required.
- D. Contractor shall retain warranties until time specified for submittal.

1.05 TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during construction with the City of Santa Rosa permission, Contractor shall submit a draft warranty for that equipment or component within ten (10) days after acceptance of that equipment or component.
- B. On or before the Contractor submits its final application for payment, Contractor shall submit all warranties and related documents in final form. The City of Santa Rosa will provide comments to Contractor and Contractor must revise the content of the warranties as required by District prior to City of Santa Rosa approval of Contractor's final Application for Payment.
- C. For items of Work that are not completed until after the date of Completion, Contractor shall provide an updated warranty for those items of Work within ten (10) days after acceptance, listing the date of acceptance as start of warranty period.

END OF SECTION 01 78 36

SECTION 01 78 39
RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

- A. Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:
1. General Conditions, including, without limitation, Documents on Work and Completion of Work;

1.02 RECORD DRAWINGS

- A. GENERAL
1. "Record Drawings" may also be referred to in the Contract Documents as "As-Built Drawings."
 2. As indicated in the Contract Documents, City will provide Contractor with one set of reproducible plans of the original Contract Drawings.
 3. Contractor shall maintain (1) set of marked-up plans and shall transfer all changes and information to those marked-up plans, as often as required in the Contract Documents, but in no case less than once each month. Contractor shall submit to the Project Inspector one set of reproducible vellums of the Project Record Drawings ("As-Built") showing all changes incorporated into the Work since the preceding monthly submittal. The As-Built shall be available at the Project Site. The Contractor shall submit reproducible vellums at the conclusion of the Project following review of the blue line prints.
 4. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.
 5. All deviations in construction, including but not limited to pipe and conduit locations and deviations caused by without limitation Change Orders, Construction Directives, RFI's, and Addenda, shall be accurately and legibly recorded by Contractor.
 6. Locations and changes shall be done by Contractor in a neat and legible manner and, where applicable, indicated by drawing a "cloud" around the changed or additional information.

1.03 RECORD DRAWING INFORMATION

- A. Contractor shall record the following information:
1. Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.
 2. Actual numbering of each electrical circuit.
 3. Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Contract Drawings.
 4. Locations of all items, not necessarily concealed, which vary from the Contract Documents.

5. Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
 6. Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stub outs, invert elevations, etc.
 7. Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.
- B. In some instances, this information may be recorded by dimension. In other instances, it may be recorded in relation to the spaces in the building near which it was installed.
- C. Contractor shall provide additional drawings as necessary for clarification.
- D. Contractor shall provide reproducible record drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."

1.04 RECORD SPECIFICATIONS

- A. Contractor shall mark each section legibly to record manufacturer, trade name, catalog number, and supplier of each Product and item of equipment actually installed.

1.05 MAINTENANCE OF RECORD DOCUMENTS

- A. Contractor shall store Record Documents apart from documents used for construction as follows:
1. Provide files and racks for storage of Record Documents.
 2. Maintain Record Documents in a clean, dry, legible condition and in good order.
- B. Contractor shall not use Record Documents for construction purposes.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01 78 39

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.01 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.

1.02 RELATED SECTIONS

- A. Section 31 20 00 - Earth Moving
- B. Section 31 23 33 – Trenching and Backfilling
- C. Section 32 13 13 - Concrete Pavement

1.03 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Exploration by ENGEO Incorporated dated June 1, 2021.

1.04 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.

1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Division 1 of the technical specifications.
- 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.

1.06 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.

1.07 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner. Avoid damaging materials designated for salvage.
- C. Unidentified Materials: 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 Owner. If necessary, the Owner 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

2.01 SOIL MATERIALS

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.01 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.
- D. Delineate limits of construction with construction fencing.

3.02 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.

3.03 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to the Owner.
- B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the Owner'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 Owner's Representative.

3.04 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 Owner or others unless authorized in writing by the Owner, 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 Owner and utility company affected. Notify Owner 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 wall of concrete minimum 6-inches thick.

3.05 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.

3.06 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 Owner'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.

3.07 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.
- C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
- D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.08 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 33 - Trenching and Backfilling.

3.09 DISPOSAL

- A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION 02 41 00

SECTION 03 30 00
SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SCOPE

- A. Provide concrete walks, precast walls, complete and in place, as shown and specified. The scope of work outlined in this Section includes the following items of work, as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to the following items:
1. Final subgrade preparation and paving base
 2. Pedestrian concrete paving at sidewalk replacement
 3. Pedestrian concrete paving at new picnic plaza areas
 4. Retaining and freestanding landscape walls
 5. Concrete footings for site furnishings, mechanical, carpentry, and electrical items as shown.

1.02 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Divisions 1 Specifications Sections, apply to this section.
- B. Related Work:
1. Section 32 91 19: Earthwork
 2. Section 01 56 39: Demolition
 3. Section 32 84 00: Irrigation System

1.03 QUALITY ASSURANCE

- A. Materials and methods of construction shall comply with the following standards:
1. American Society of Testing and Materials, (ASTM).
 2. American Concrete Institute, (ACI).
 3. California Building Code (CBC)
 4. State Standard Specifications, California Department of Transportation.
 5. American National Standards Institute, (ANSI).
 6. Bay Area Air Quality Management District, Sandblasting Guidelines.
- B. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source and each admixture from the same manufacturer.

- D. Maintain field records of time, date of placing, curing and removal of forms of concrete in each portion of work.
- E. Samples:
 - 1. Sample panel for concrete walk, precast wall: Before ordering material for concrete, provide sample panel, minimum 4 'X 4' of each color and finish, using specified materials. Show color, texture, pattern, edging, and joint treatments.
 - a. The approved sample panel may not be a portion of the work and shall not remain in place. Contractor will be required to provide additional panels as necessary, until approved.

1.04 SUBMITTALS

- A. Submit concrete mix designs to City's Representative. Obtain approval before placing concrete.
- B. Product data:
 - 1. Submit complete materials list of items proposed for the work. Identify materials source.
 - 2. Submit admixture, curing compound, retarder, and accessory item product data, if used.
 - 3. Submit material certificates for aggregates, reinforcing, and joint fillers.
- C. Submit concrete delivery tickets. Show the following:
 - 1. Batch number.
 - 2. Mix by class or sack content with maximum size aggregate.
 - 3. Admixtures.
 - 4. Slump.
 - 5. Time of loading.
- D. Submit concrete test reports.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Work notification: Notify CITY PUBLIC WORKS at least 24 hours prior to installation of concrete.
- B. Establish and maintain required lines and grade elevations. All concrete shall slope to drain with no ponding of water.
- C. Do not install concrete work over wet, saturated, muddy, or frozen subgrade.
- D. Do not install concrete when air temperature is below 40 degrees F. Use of calcium chloride, salt, or any other admixture to prevent concrete from freezing is prohibited.
- E. When temperatures is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when temperatures is above 90 degrees F, reduce mixing and delivery to 60 minutes.
- F. Protect adjacent work.
- G. Provide temporary barricades and warning lights as required for protection of project work and

public safety.

H.

PART 2 - PRODUCTS

2.01 FORMWORK

- A. Furnish formwork and form accessories according to ACI 301-10.
- B. Wood or metal formwork shall be of sufficient strength to resist concrete placement pressure and to maintain horizontal and vertical alignment during concrete placement. Provide forms straight, free of defects and distortion, and height equal to full depth of concrete work.
 - 1. Provide 2" nominal thickness, surfaced plank wood forms for straight sections. Use flexible metal, 1" lumber or plywood forms to form radius bends.

2.02 STEEL REINFORCEMENT

- A. Reinforcing steelbar: ASTM A615, A616, or A617, Grade 60, new domestic deformed steel bars.
- B. Steel Dowels: ASTM A615

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type 1, natural color, unless otherwise noted.
- B. Aggregate: Provide ASTM C33 normal weight aggregates, 3/4" maximum size, clean, uncoated crushed stone or gravel coarse aggregate free of materials which cause staining or rust spots; fine aggregate shall be clean natural sand.
- C. Water: Clean, fresh, and potable.

2.04 ADMIXTURES

- A. Calcium Chloride: Do not use calcium chloride in concrete, unless specifically specified by Engineer.
- B. Water-reducing admixture: ASTM C494.
- C. All admixtures, if used, shall conform to C.B.C. Vol. 2, Section 1905A.2. Use of additional admixtures is accepted based upon approval by Engineer.

2.05 CONCRETE MIXES

- A. Provide Class A ready-mixed concrete. Batch mixing at site not acceptable.
 - 1. For roadway paving: Use Portland Cement Concrete containing not less than 658 pounds of Portland Cement per cubic yard to allow for 7 day cure time, with a compressive strength of not less than 4000 p.s.i. at 28 days.

2. For all other site concrete: Use Portland Cement Concrete containing not less than 564 pounds of Portland Cement per cubic yard, with a compressive strength of not less than 3000 p.s.i. at 28 days.

B. Indicate water added to mix at job site on each delivery ticket. Show quantity of water added. Site water tempered mixes exceeding specified slump range will be rejected as not complying with specification requirements.

C. Retempering of concrete will not be permitted.

2.06 INTEGRAL COLOR

A. Concrete Color Additives: Custom colors, as indicated in contract drawings and details.

2.07 GLARE REDUCING AGENTS

A. Lampblack in dry form, in accordance with the requirements of ASTM D209-81 "Standard Specifications for Lampblack", in proportion from ½ to ¾ of a pound per cubic yard of concrete. OMIT LAMP BLACK ON ALL SPLASH PAD PAVING WITH INTEGRAL COLOR.

B. An approved liquid or semi-paste black colorant intended for use integrally in concrete mixes. The proportion required generally from 10 to 40 ounces liquid measure per cubic yard of concrete, may be affected by the colorant used. Curing, in this case, shall be by the pigmented curing compound method.

2.08 ACCESSORIES

A. Granular base: Class II Aggregate Base, clean and uncoated.

B. Joint Filler: ASTM D1751, premolded non-extruding asphalt-impregnated fiberboard, thickness indicated.

C. Curing compound: ASTM C309, non-yellowing, non-staining liquid membrane-forming type containing a fugitive dye. Chlorinated rubber compounds not acceptable for exterior use.

D. Joint Sealants: Two-component polysulfide or polyurethane elastomeric type complying with Federal Specifications TT-S-00227, self-leveling, designed for foot traffic in pedestrian areas.

E. Form release agent: Non-staining chemical form release agent free of oils, waxes, and other materials harmful to concrete.

F. Reveals/Chamfer strips: Shall be plastic or polyvinyl coated for easy release. Available from Barker Steel, www.barker.com, or approved equal.

G. Provide all stirrups, ties, anchors, shown or required to be cast into precast members.

H. Bolts, Nuts, and Washers: ASTM A307. Provide hot-dip galvanized fasteners for exterior use. Paint to match adjacent metal work.

- I. Waterproofing at walls shall be Tremco 250-GC, or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine subgrades and installation conditions. Immediately inform the City's Representative of any discrepancy between the Drawings and Specifications and actual conditions and secure approval to proceed. Do not start concrete work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Proof roll the subgrade and do all necessary rolling and compacting to obtain firm, even subgrade surface. Fill and consolidate depressed areas. Remove uncompactable materials, replace with clean fill and compact to 90% of the maximum dry density in accordance with ASTM D1557-70.
- B. Provide minimum 4" depth of compacted base material at walks. Compact base to 95% of the maximum dry density in accordance with the project Geotech Report
- C. Remove loose material and debris from base surface before placing concrete.
- D. Install, align, and level forms. Stake and brace forms in place. Maintain following grade and alignment tolerances:
 - 1. Top of form: Maximum 1/8" in 10'-0".
 - 2. Vertical face: Maximum 1/2" in 10'-0".
- E. Coat form surfaces in contact with concrete with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage.
- F. Install, set, and build-in work furnished under other specification sections. Provide adequate notification for installation of necessary items.
- G. Install pipe sleeves for irrigation system furnished under Section 32 84 00. Stake location of irrigation sleeves.

3.03 PLACING REINFORCEMENT

- A. Place all reinforcement as shown on the drawings. Place accurately and securely fasten and support reinforcement to prevent displacement before or during pouring. Hang footing bars from forms. Support wire mesh with suitable metal cradles.
- B. Clean, bend and place reinforcement in accordance with current requirements of the ACI Manual of Concrete Practice.
- C. Reinforcement Splices:
 - Welded wire fabric - one mesh minimum.
 - Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.

3.04 TESTING

- A. Provide slump test on first load of concrete delivered each day and whenever requested due to changes in consistency or appearance of concrete.

3.05 INSTALLATION

A. Concrete placement:

1. Comply with ACI 304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.
2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing. In cold weather comply with ACI 306, "Cold Weather Concreting". In hot weather comply with ACI 305, "Hot Weather Concreting".
3. Moisten base to provide a uniform dampened condition at the time concrete is placed. Verify structures are at required finish elevation and alignment before placing concrete.
4. Place and spread concrete to the full depth of the forms. Use only square-end shovels or concrete rakes for hand-spreading and consolidating operations to prevent segregation of aggregate and dislocation of reinforcement.
5. Place concrete in a continuous operation between expansion joints. Provide construction joints where sections cannot be placed continuously.
6. Place concrete as indicated on the plans in one course, monolith construction, for the full width and depth of concrete work.
7. Strike-off and bull-float concrete after consolidating. Level ridges and fill voids. Check surface with a 10'-0" straightedge. Fill depressions and refloat repaired areas. Darby the concrete surface to provide a smooth level surface ready for finishing.

B. Joints:

1. Provide expansion joints using premolded joint filler at concrete work abutting curbs, walls, structures, walks, and other fixed objects.
 - a. Expansion joints shall be formed provided at the location and intervals as shown on the plans and details.
 - b. Approved joint material shall be placed with top edge 1/4 inch below the paved surface, and shall be securely held in place to prevent movement. Joint and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming.
 - c. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint sealant to just below adjacent paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.
 - d. Install joint fillers full-width and depth of joint. Recess top edge below finish grade for joint sealants.
 - e. Provide joint fillers in single lengths for the full slab width, whenever possible. Fasten joint filler sections together when multiple lengths are required.
 - f. Protect the top edge of the joint filler during concrete placement.
2. Score Joints:

- a. Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after brooming. See plans and details for size and locations.
- C. Dowels:
 - 1. All new concrete walkways shall be doweled into new and existing concrete walk ways and curbing. See plans and details for size and location.
- D. Finishes:
 - 1. Broom Finish: Shall be obtained by drawing a stiff bristled broom across a floated finish. Direction of brooming to be perpendicular to direction of work or otherwise shown on drawings.
- E. Curing:
 - 1. Cure concrete with a clear, non-staining liquid membrane-forming compound. Spray apply in accordance with manufacturer's recommended coverage rate. Apply curing compound immediately after completing surface finish.

3.06 TOLERANCES

- A. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"

3.07 PROTECTION

- A. Protect all existing and new concrete work from damage due to construction and vehicular traffic until Final acceptance. Exclude construction and vehicular traffic from concrete pavements for at least 14 days.
- B. Protection: Protect existing and new concrete items from chipping, spalling, cracking, or other damage until the Work is accepted by the Owner.

3.05 DEFECTIVE CONCRETE

- A. Concrete work which does not meet the Mockup, Contract Specifications or Contract Drawings shall be considered defective concrete.
- B. Color and finish of all concrete work shall match. Inconsistent color, and finishing shall be considered defective concrete.
- C. All walls shall be plumb, straight with top of wall held level. Walls which are not plumb, straight, or level shall be considered defective concrete.
- D. All joints shall be straight and true. Joints which are not straight shall be considered defective concrete.
- E. Concrete work which ponds, does not conform to ADA requirements, does not match grading, is of poor finish, has poor scoring depth, map cracking, chipped, cracked, or otherwise deemed non acceptable shall be considered defective concrete.

- F. Defective concrete shall be repaired or replaced as directed by the Landscape Architect, at no added expense to the Contract.
 - 1. Landscape Architect's authorization for the Contractor to repair defective concrete work does not provide an acceptance of defective concrete work. All final repair work that does not meet the approval of the Landscape Architect shall be rejected, removed and replaced at no additional cost to the contract.
- G. In general, minor defective work may be repaired by use of dry pack. If defective work is serious or affects the strength of the structure or the appearance, the Landscape Architect may require the removal and replacement of the portion or all of the work.
 - 1. Immediately after removing forms, all concrete surfaces shall be inspected any poor joints voids, rock pockets, tie holes, except as specified, etc., shall be patched at once, but not until the surfaces have first been reviewed by the Landscape Architect. Submit patching mixture and method proposed for use, for review prior to commencing work.
 - 2. Repaired or Replaced work shall match existing work. Work which does not match may require full removal and replacement.
 - 3. All labor, materials, equipment, incidentals, and work related to the repairs or replacement of Concrete work shall be done at no additional cost to the Contract.

3.08 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from concrete operations.
- B. Sweep concrete sidewalks and pavement; wash free of stains, discoloration, dirt, and other foreign material immediately prior to final acceptance.

END SECTION 03 30 00

SPECIFICATION 03 30 10

SPRAY PAD CONCRETE

PART 1 – GENERAL

1.01 SCOPE:

- A. Provide replacement concrete paving and coping at pool deck and new concrete paving at the Splash Pad. The scope of work outlined in this Section includes the following items of work, as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to the following items:
 - 1. Final subgrade preparation and paving base
 - 2. Replacement of pool deck, coping, and associated ramps and walls as detailed in the Contract Drawings
 - 3. New concrete paving at the splash pad and interface with surrounding pedestrian paving, landscape walls and pool deck

- B. Provide labor, materials, and equipment as required to install cast-in-place concrete as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to Replacement Pool Deck & Coping and Splash Pad Concrete Paving.

1.02 QUALITY ASSURANCE:

- A. All Work of this Section shall be performed by the swimming pool contractor/subcontractor. Pool Contractor to be licensed by the State to accomplish swimming pool construction (C-53).

- B. References:
 - 1. Provide a list of five projects of similar scope accomplished by the Contractor for review before Bidding. (Prequalification of the Contractor, C-53 required).

 - 2. Qualifications of Workers:
 - a. The contractor/subcontractor for this portion of the Work shall have been successfully engaged in the business swimming pool cast-in-place concrete for at least five (5) years immediately before commencement of this Work and shall demonstrate to the Architect a record of satisfactory artistry.

 - b. For actual construction operations, use only thoroughly trained and experienced workers who are completely familiar with the specified materials and methods.

 - c. Provide at least one person who shall be present during the execution of this portion of the Work and who shall be thoroughly familiar with the materials and methods specified who shall direct all Work performed under this Section. Submit the resume of the designee.

1.03 SUBMITTALS AND SUBSTITUTIONS:

- A. Provide submittals of concrete mix designs, admixtures, & catalog cuts in conformance with

Section 01 30 00 - Shop Drawings requirements.

1.04 PRODUCT HANDLING:

- A. Delivery: Deliver materials to the Project Site as Ready-Mix product or any additives in the manufacturer's original unopened containers with all labels intact and legible.
- B. Storage: Store materials (other than Ready-Mix) undercover to prevent damage and contamination, and store only the specified materials at the Project Site.
- C. Protection: Use all means necessary to protect the cast-in-place concrete before, during, and after installation and protect the installed Work and materials of all other trades.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary. Failure to make deck embeds in the correct locations and levels, failure to bond metal components and reinforcement, and failure to achieve the proper finish and/or cure will cause rejection and necessitate the need for removal and replacement with the adequate product.

PART 2- PRODUCTS

2.01 CONCRETE:

- A. All concrete, unless otherwise specifically reviewed and specifically permitted, concrete shall be transit-mixed following ASTM C94.
- B. The control of concrete production shall be under the supervision of a recognized testing agency, approved by the Architect following Section 01 40 00 Quality Control of the Specifications.
- C. Quality: All concrete shall have the following minimum compressive strengths at twenty-eight (28) days and shall be proportioned within the following limits:
 - 1. Pool walls & floors, surge tank, pump pit, backwash tank:
 - a. $f'c = 4,500$ psi. minimum compressive strength.
 - b. 3/4 inch maximum size aggregate.
 - c. 6.00 minimum sacks of cement per cubic yard.*
 - d. 4-inch maximum slump.
 - e. For estimate only: to be determined by mix design. (Fly Ash is not an acceptable substitute for Portland Cement) but is required to be part of mix design.* - The amount of pozzolan to be used shall not be less than the amount that has been determined by service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag to be used shall not be less than the amount tested following ASTM C1012.
 - f. W/CM - a water-cement ratio of .45 or less
 - 2. Cement: All cement shall be Portland cement conforming to ASTM C-150, type V, and shall be one manufacturer's product.

3. Aggregates:
 - a. Shall conform to "Standard Specifications for Concrete Aggregates," ASTM C33, except as modified herein.
 - b. Coarse Aggregate: Clean sound-washed gravel or crushed rock. Crushing may constitute not more than 30% of the total coarse aggregate volume. No more than 5% flat, thin, elongated, or laminated material or more than 1% deleterious material shall be present—3/4 aggregate graded from 1/4 to 3/4 inch, fineness modulus 6.90 to 7.40.
 - c. Fine Aggregate: Washed natural sand of hard, strong particles and shall contain not more than 1% of deleterious material, fineness modulus 2.65 to 3.05.
4. Water: Clean, fresh, free from acid, alkali, organic matter, or other impurities liable to be detrimental to the concrete (potable).
5. Admixtures:
 - a. Admixtures shall be used only upon review of the Architect as part of mix design and submittal.
 - b. air-entraining admixture: Conform to ASTM C260.
 - c. water-reducing admixture: Conform to ASTM C494.
 - d. Xypex C-500 - 3 percent of the weight of the Portland Cement typical on all deck work.
6. Concrete Mix Design shall conform to ACI 318, and because of the water-soluble sulfates in soil, according to the geotechnical report, an exposure class of S3 is required. Water Soluble Sulfates (SO₄) in the soil is greater than 2.0 and/or in water greater than 10,000

2.02 FORMING MATERIALS:

- A. See section 03 10 10 Forming

2.03 CURING:

- A. Protect freshly deposited concrete from premature drying and maintain it without drying at a relatively constant temperature for the time necessary for the hydration of the cement and proper hardening of the concrete.
- B. Curing shall immediately follow the finishing operation. Keep concrete continuously moist for at least seven days using one of the following materials or methods.
 - (28) Ponding or continuous sprinkling.
 - (29) Absorptive mat of fabric (burlap) continuously wet.
 - (30) Sand or other covering kept continuously wet.
 - (31) Prevent rapid drying (hydration) of the concrete at the end of the curing period.

- (32) During the curing period, protect the concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration. Protect all finished concrete surfaces from damage caused by construction equipment, materials, or methods.
- (33) No liquid curing compounds are to be used unless prior review and approval is received as shop drawing submittal see Section 01 30 00

2.04 PROTECTION:

- A. protect all finished surfaces from stains, sealant tracking, or abrasions. Protect surfaces or edges by leaving forms in place or by providing temporary covers. Protect all concrete from rain, flowing water, or mechanical injury (vibration).
- B. Protect floor slabs from the dropping of plaster, paint, dirt chemicals, and another marring by covering with polyethylene plastic sheet, well lapped and sealed (after curing is complete). Maintain covering in good condition until the danger of potential damage is passed.
- C. Do not set scaffolding up over new decking without submitting a plan to protect concrete from the scaffold and work above.

2.05 EXPANSION JOINTS: (USE 1/2" THICKNESS BY DEPTH OF CONCRETE PLACED).

- A. Use self-expanding cork expansion joint as manufactured by Burke. Preformed from selected cork particles and bonded together with an insoluble resin. Joint material to be resistant to acids and alkalis, and flexible, waterproof, and light in color. It will not extrude when compressed to 50% of its original thickness and recover to approximately 95% when released. Use the same material (cork) in doweled expansion joints.
- B. Use Thiokol-based Polysulfide sealant on tactile side of joint.

PART 3- EXECUTION

3.01 SURFACE CONDITIONS:

- A. Inspection:
 - 1. Before all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
 - 2. Verify that all items to be embedded in concrete are in place and that concrete may be placed to the lines and elevations shown on the Drawings, with all required clearance from reinforcement. Pulling reinforcement into position after pouring is not allowed.
 - 3. Verify that all engineered fill is in place and compacted to the proper density.
 - 4. Dewater as may be required. Verify adequacy of the substrate with soils engineer.
 - 5. Discrepancies:
 - a. In the event of a discrepancy, immediately notify the Architect.
 - b. Do not proceed with installation in areas of the discrepancy until all such

discrepancies have been fully resolved.

- c. failure to notify the Architect in writing of discrepancies shall constitute acceptance of existing conditions as fit and proper to receive the Work.

3.02 CONVEYING AND PLACING CONCRETE:

- A. Before placing concrete, mixing and conveying equipment shall be well cleaned, and the forms and space to be occupied by concrete shall be thoroughly cleaned and wetted. Groundwater shall be removed until the completion of the Work as a part of the Work if required.
- B. No concrete shall be placed in any unit of Work until all formwork has been completely constructed, all reinforcement has been secured in place, all items to be built into concrete are in place, and form ties at construction joints tightened.
- C. Concrete shall be conveyed from mixer to place of final deposit in such a way to prevent the separation or loss of ingredients. It shall be placed as nearly as practicable in its' final position to avoid re-handling or flowing. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor will it be dropped more than six (6) feet. Use tremies, spouts, and dump boxes in deep sections. Vibrators are not acceptable for facilitating concrete transport.
- D. Concrete shall be tamped and spaded to ensure proper compaction into all parts of forms and around reinforcement. A mechanical vibrator shall be used to compact the concrete thoroughly. Vibration must be by direct action in the concrete and not against forms or reinforcement.

3.03 CONSTRUCTION JOINTS:

- A. Construction joints to be provided at locations and in the manner shown on the Drawings. The Contractor shall notify the Owner before pouring concrete if, in his opinion, joints, as located, will not allow concrete to be free from cracking and leaking (less porous).

3.04 FINISHES:

- A. Spray Pad floor and gutter walls: Medium broom finish.
- B. Concrete Decks: Colored per Landscape Plans.

3.05 PROTECTION AND CURING:

- A. Concrete shall be protected from harmful action of the elements and defacement of any nature during construction.
- B. All forms must be kept wet to prevent drying out of the concrete – premature hydration of concrete.
- C. All concrete surfaces, including footings, must be kept wet for at least seven (7) days after the concrete is placed. (Pool floor & walls and building floors).
- D. Apply the appropriate curing procedure to decks, as specified in this Section, being curing process immediately after placement.

3.06 FORM REMOVAL:

- A. Take care in removing forms so that surfaces are not marred or gouged and that corners are true, sharp, and unbroken. – See Section 03 10 10 Formwork

3.06 DEFECTIVE CONCRETE

- A. Concrete work which does not meet the Mockup, Contract Specifications or Contract Drawings shall be considered defective concrete.
- B. Color and finish of all concrete work shall match. Inconsistent color, and finishing shall be considered defective concrete.
- C. All walls shall be plumb, straight with top of wall held level. Walls which are not plumb, straight, or level shall be considered defective concrete.
- D. All joints shall be straight and true. Joints which are not straight shall be considered defective concrete.
- E. Concrete work which ponds, does not conform to ADA requirements, does not match grading, is of poor finish, has poor scoring depth, map cracking, chipped, cracked, or otherwise deemed non acceptable shall be considered defective concrete.
- F. Defective concrete shall be repaired or replaced as directed by the Landscape Architect, at no added expense to the Contract.
 - 1. Landscape Architect's authorization for the Contractor to repair defective concrete work does not provide an acceptance of defective concrete work. All final repair work that does not meet the approval of the Landscape Architect shall be rejected, removed and replaced at no additional cost to the contract.
- G. In general, minor defective work may be repaired by use of dry pack. If defective work is serious or affects the strength of the structure or the appearance, the Landscape Architect may require the removal and replacement of the portion or all of the work.
 - 1. Immediately after removing forms, all concrete surfaces shall be inspected any poor joints voids, rock pockets, tie holes, except as specified, etc., shall be patched at once, but not until the surfaces have first been reviewed by the Landscape Architect. Submit patching mixture and method proposed for use, for review prior to commencing work.
 - 2. Repaired or Replaced work shall match existing work. Work which does not match may require full removal and replacement.
 - 3. All labor, materials, equipment, incidentals, and work related to the repairs or replacement of Concrete work shall be done at no additional cost to the Contract.
- B. Cut out, remove and replace, or repair concrete not meeting minimum strength requirements, not formed as indicated, not true, plumb or level, not to required elevations, containing cracks detrimental to performance or appearance, and containing shavings and debris, or with honeycombs or voids.
- C. Promptly perform Work required to repair, patch, replace, render properly cleaned surfaces, or otherwise make good any defective concrete, at Contractor's expense, including all-expense of additional inspections, tests, or supervision made necessary as a result of defective concrete.

3.07 CLEAN-UP:

- A. Upon completion of cast-in-place concrete, remove all debris, materials, and equipment occasioned by this Work.

END OF SECTION 03 30 10

SECTION 05 70 00
DECORATIVE METAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: 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, these major items:
 - 1. Shapes, sleeves, anchors, connectors, plates, rails, edges, items embedded in concrete required, but which are not specified in other sections.
 - 2. Metal handrails
 - 3. Metal Shade Structure Posts
 - 4. Primer for metal items which are not galvanized.
 - 5. Welding.
- B. Examine all drawings and specifications and include all miscellaneous metal which is specified in other sections. Provide all connections, anchors, bolts, and other fastenings as required. Do all cutting, punching, drilling and tapping required for proper assembly of the work.

1.02 REFERENCES

- A. ASTM A123 - Zinc (Hot Galvanized) coatings on Products fabricated from rolled, pressed and forged shapes, plates, bars, and strip.
- B. ASTM A153 - Zinc coating (Hot Dip) on iron and steel hardware.
- C. ASTM A386 - Zinc coating (Hot Dip) on assembled steel products.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate profiles, edge and joint conditions, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1.04 QUALITY ASSURANCE

- A. References:
 - 1. American Society of Testing and Materials (ASTM)
 - 2. American Welding Society (AWS)
 - 3. American Institute of Steel Construction (AISC)

- B. Field measurement: Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to the City Representative all conditions, which prevent proper execution of this work.
- C. Shop assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordination of installation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel shapes: conform to ASTM A36.
- B. Steel pipe: conform to ASTM A53, Grade B. Schedule 40.
- C. Malleable iron castings: conform to ASTM A47.
- D. Welding rods: conform to requirements of AWS for intended use.
- E. Steel plate: conform to ASTM A283, Grade A.
- F. Steel tubing: conform to ASTM A501.
- G. Bolts, Nuts, and Washers: ASTM A325 and A307, galvanized as follows:
 For A307 items: Zinc electroplated per ASTM B633.
- H. Touch-up for galvanized surfaces: All State #321 Galvanizing Powder (30% tin, 30% zinc, 40% lead and flux).
- I. Miscellaneous material: as indicated or specified.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured. On finished surfaces, grind all welds smooth and flush with base metal
- C. Exposed Mechanical Fastenings: Flush countersunk stainless steel screws or bolts; concealed where possible; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise. Where items are to be embedded in concrete or masonry, provide welded-on anchors or lugs as indicated or required
- E. Assemble to give ample strength and stiffness.

- F. Scribe and fit for best appearance where exposed.

2.03 GALVANIZING

- A. Galvanize all metal items so specified or indicated on plans. Use the hot dip process, conforming to ASTM A123. Galvanizing shall be done after fabrication.
- B. Average weight of zinc coating per square foot of actual surface: Not less than 2.0 ounces, with no individual specimen showing less than 1.8 ounces (One ounce of zinc corresponds to a coating thickness of 0.0017).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects and securely and rigidly attached to supporting construction and as detailed.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Connections and anchors shall be adequate to sustain normal loads, which may be imposed, securely welded or bolted, conforming to AISC standards. Excess length of bolts where exposed to view to be cut off and ground smooth. Use spacer washers when fastening through finish materials.
- D. All welding shall conform to requirements of the Committee for Standard Tests for Welds of the American Welding Society. All welding shall be electric arc process. Welds exposed in finish work shall be filled out flush, ground and dressed. Welders for structural shall be certified.
- E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION 05 70 00

SECTION 07 90 10

JOINT SEALANT

PART 1 – GENERAL

- 1.01 Division 1 and the General Conditions apply to all work of this Section.
- 1.02 Description:
- A. Work Included:
 - 1. Preparing sealant substrate surfaces.
 - 2. Sealant and substrate.
- 1.03 References:
- A. ASTM C804 - Use of Solvent-Release Type Sealants.
 - B. ASTM 962 - Guide for the use of Elastomeric Joint Sealants.
 - C. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
- 1.04 Submittals:
- A. Submit product data under provisions of Section 01 30 00.
 - B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.
- 1.05 Quality Assurance:
- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with a minimum of five years of documented experience.
 - B. Applicator: Company specializing in applying the work of this Section with a minimum of three years documented experience, approved by sealant manufacturer.
 - C. Conform to Sealant and Waterproofer Institute requirements for materials and installation.
- 1.06 Environmental Requirements:
- A. Do not install solvent curing sealants in enclosed buildingspaces.
 - B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 – PRODUCTS

- 2.01 Manufacturers:
- A. Manufacturers and products are listed below for each sealant type.
 - B. Substitutions: Under the provision of Section 01 3000.
- 2.02 Sealant:
- A. Polysulfide Based Sealant based on Thiokol: (Pool Decks & Pool Expansion Joints) Compound shall be two-part, chemically curing type, supplied in ready-to-use form. Compounds shall be non-toxic and non-staining. Colors shall match adjacent surfaces (Grey or white). Use self-leveling pour grade where possible in flatwork joints and, as shown on drawings. Use gun grade on vertical and undersides, as shown on drawings. Sealant shall conform to ASTM C-920, Type M, Grades NS, Class 25. (IT-S-00227E or IT-S-00230C, Type I-pourable, or II gun-grade, Class A).
Note: Sealant used in flatwork paving with heavy pedestrian traffic shall be of the type to cure to a durometer hardness of 50 to 60 or better. Submit samples before installation. (IT-S-227E, Class B).
Primer: use Sealtight P/G Primer or equal.
- 2.03 Accessories:
- A. Primer: Non-staining type, recommended by sealant manufacturer to suit the application.
 - B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer, compatible with joint forming materials.

PART 3 - EXECUTION

- 3.01 Examination:
- A. Verify that joint openings are ready to receive work, and field measurements are shown on Drawings and recommended by the manufacturer.
 - B. The beginning of installation means the installer accepts the existing substrate.
- 3.02 Preparation:
- A. Clean and prime joints following the manufacturer's instructions. Prime if recommended by the manufacturer.
 - B. Remove loose materials and foreign matter, which might impair the adhesion of the sealant.
 - C. Verify that joint backing and release tapes are compatible with sealant.
 - D. Perform preparation following ASTM C804 for solvent release sealant and C962 for elastomeric sealants.
 - E. Protect elements surrounding the work of this Section from damage or disfiguration.
- 3.03 Installation:

- A. Install sealant following the manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve the required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install a bond breaker where joint backing is not used.
- E. Apply sealant within the recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints concave, unless otherwise detailed.

3.04 Cleaning and Repairing:

- A. Clean work under provisions of Section 01 7000.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by the work of this Section.

3.05 Protection of Finished Work:

- A. Protect sealant until cured.

3.06 Schedule:

	Location	Type	Color
A.	Exterior and interior joints in horizontal surfaces of concrete	One-part Pourable Urethane	As selected from mfr's standard colors

END OF SECTION 07 90 10

SECTION 10 40 00

SIGNAGE

PART 1 – GENERAL

- 1.01 Division 1 and the General Conditions apply to all work of this Section.
- 1.02 Description:
- A. Work Included: Furnish all labor, materials, equipment, and services necessary to complete the applicable work within this Section of the Specifications as shown on the drawings and/or specified herein. The District will dictate the exact placement of signage, which may or may not be indicated on drawings.
 - B. Deck signs (occupant load sign with clearly legible letters not less than 4" high located per County Health Department representative instructions.)
 - C. Chemical Storage signs (Haz-Mat)
 - D. Safety Signs

PART 2 – PRODUCTS

- 2.01 Signage:
- A. Sign material to be scratch resistant, non-static, fire retardant, reflective, washable non-glare surface (High-Intensity Prismatic (HIP) sheeting. Sheeting to be mounted on sheet aluminum substrate having rounded or radius corners (1/2 inch) and pre-drilled to accept stainless steel mounting bolts (.20 in hole pre-drilled in each corner). Impervious to most acids, alkaline's, alcohol, solvent, abrasives, and boiling water. NEMA rated self-extinguishing, each sign mounted on sheet aluminum (.040 inches or 1 mm) and printed in UV- stable ink with clear laminate 4.0 mil Vinyl with permanent acrylic adhesive and 2.5 mils, PVC film (optically clear) cover.
 - B. Spray Ground Occupancy & safety signs.
 - 1. Rules – black letters on white background.
 - 2. Rescue Breathing & 911
 - 3. No Running
 - 4. Spray Ground Capacity
 - 5. Shower before entering the Spray Pad
 - 6. Sickness sign
 - C. Chemical safety signs for Acid & Chlorine. – (for each chemical stored) Submit shop drawings of the Haz- mat MSDS sheets.
 - D. MSDS Station – Wall-mounted station - #1F-17463 by Lab Safety Supply 800 3560783

- 2.02 Submittals:
- A. The contractor shall submit a material sample and full-size mock-up of copy to Architect for review in compliance with Section 01 30 00. Do not order signs before review.

PART 3 – EXECUTION

3.01 Inspection and Preparation:

- A. The contractor shall be responsible for inspection of the site, approval of mounting conditions, and field measurements for this work.

3.02 Installation:

- A. Shall comply with all manufacturer's recommendations.
- B. All signs shall be installed positively, securely, and permanently.

3.03 Cleaning:

- A. Clean finished installation of dirt and finger marks, leave the work area clean and free of debris.

END OF SECTION 10 40 10

SECTION 12 93 00
SITE FURNISHINGS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. The General Conditions and all other Contract Documents for this project are complementary and applicable to this Section of the Specifications.
- B. Work Included: Furnish all labor, materials, equipment and services necessary to provide and construct, repair, or install the site elements, complete in place, as shown and specified, including, but not limited to:
 - 1. Benches
 - 2. Picnic tables
 - 3. Concrete Mowband
 - 4. Concrete Seatwall
 - 5. Waterplay Equipment
 - 6. Beach Ball Bollard
 - 7. Synthetic Turf
 - 8. Shade Sails
 - 9. Synthetic Turf
- C. Related Work:
 - 1. Section 03 30 00: Site Concrete Work
 - 2. Section 13 15 20: Water Play Equipment

1.02 SUBMITTALS

- A. Submit shop drawings where noted to the City Representative for approval before installing any manufactured items. Plans shall include dimensions, color, finish, structural design (custom items), and connection details.
- B. Submit catalog cuts, samples and manufacturers literature of all manufactured items in this section to the City Representative for approval before installation.
 - 1. Provide color samples, brushouts, or charts for all items. Final colors to be selected by City Representative and a sample submitted for approval.

PART 2 - PRODUCTS

2.01 MANUFACTURED ITEMS

- A. All play apparatus shall be as noted on plans.
- B. Benches: per plans
- C. Filter Fabric:
 - 1. Product shall be 100% polyester nonwoven needle-pinched engineering geotextile fabric; Fibar felt or approval equal. Weight: min. 3.5 oz./sq. yd. Install with 12" overlap on all seams.
- D. Picnic tables: per plans
- E. Water Play Equipment and Accessories: per plans
- F. Trash Receptacles: per plans
- G. Synthetic Turf: per plans

2.02 MISCELLANEOUS MATERIALS

- A. All other materials for site elements shall be as specified on the plans and these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Examination: Verify that conditions are satisfactory for installation of each item of site elements. If unsatisfactory conditions exist, do not begin installation until such conditions have been corrected.
- B. Play Apparatus Installation: Install products in conformance with the manufacturer's recommendations and approved shop drawings, and as indicated.
 - 1. Install products square, plumb, level, accurately aligned, and securely anchored.
 - 2. Repair abraded areas of shop-applied coating, and areas of welds where shop-applied coating has been damaged, using a primer or galvanized repair compound compatible with the shop coating. Repair paint surface per manufacturer's specifications to match undamaged finish.
 - 3. Completion: Completed installation shall be securely anchored, and free from defects and damage in material and finish.
 - 4. After installation, contractor shall have playground manufacturer representative inspect the apparatus and provide in writing affirmation that playground was installed correctly and meets safety and ADA standards and requirements.

- C. Drainage Fabric
 - 1. Install fabric as shown on drawings, overlapping all seams at least 12". Cut the fabric to fit where equipment is installed. Overlap all cuts with fabric.
 - 2. Machinery shall not disturb or travel on the drainage felt fabric.
 - 3. The Contractor shall provide a written Limited Lifetime Warranty on the drainage felt geotextile fabric. The Contractor shall provide a written five (5) year Limited Warranty (performance) from date of installation. The Contractor shall also provide a three (3) year Limited Warranty (biological degradation) from date of installation.

- D. Benches and Trash Receptacles
 - 1. Install directly onto concrete. Use manufacturer's recommended adhesive.

- E. Picnic Tables
 - 1. Freestanding, no anchorage required.

3.02 GUARANTEE

- A. At completion of project, Contractor shall provide City Representative with written guarantee from each manufacturer identifying the nature of warranty for each product component.

- B. Contractor shall provide City Representative with two (2) bound maintenance manuals identifying each piece of equipment on manufacturer's recommended maintenance program including, but not limited to, daily, weekly, and monthly check lists.

- C. Contractor to provide City Representative with minimum of two (2) gallons each type and color of paint used on apparatus with recommended surface preparation and application guidelines.

END OF SECTION 12 93 00

SECTION 13 15 10

SPRAY GROUND EQUIPMENT

PART 1- GENERAL

- 1.01 Division 1 and the General Conditions apply to all Work of this Section.
- 1.02 Description:
- A. Work Included: Supply and install spray-ground equipment and features as required for this Work as indicated on the Drawings and specified herein.
- 1.03 Quality Assurance:
- A. The spray ground contractor/subcontractor (C-53) shall perform all Work of this Section.
- 1.04 Submittals:
- A. Provide submittals per Section 01 30 00 of each piece of equipment specified herein.
 - B. Substitutions: Include with request specified item, design, catalog number, and finish for each item on which approval is being requested ten (10) days before bid opening. Unconditional approval by the manufacturer's name only will not be given. Substitutions will not be granted after the ten days or after the project bid date.
- 1.05 Product Handling:
- A. Protection: Use all means necessary to protect spray ground equipment items before, during, and after installation and to protect the installed Work of all other trades.
 - B. Replacements: In the event of damage or misalignment, immediately make all repairs and replacements necessary.

PART 2- PRODUCTS

- 2.01 Maintenance Equipment
- A. Utility Pole: 16 foot – a fiberglass pole with connectors. Lincoln #30-046 or reviewed equal. One (1) required. (to be used with leaf rake)
 - B. Pool Wall Brush with curved ends: 36" wide professional quality. Lincoln # 31-030 or reviewed equal. One (1) required.
 - C. Water Quality Test Kit, Professional Grade: Taylor Droop Test Kit Lincoln #23-040, or reviewed equal. One (1) required.
- 2.02 Fittings:

- A. Gutter Frame & Grate: Dal Dorado, Color to be selected by City.
- B. Junction Boxes: Hydrel #1719, or reviewed equal, coordinate quantity and number of predrilled holes in each box with plans. To be Cast Bronze order with pre-drilled lugs with threads for conduit sized and positioned correctly with adequate grounding lug. Must be waterproof and designed for above deck and wall mounting.

2.04 Wet Play Features & Equipment:

- A. Manifold with enough valves to support and supply each of the play features and their water demand. Waterplay model 0010-2591
 - 1. 4" dia. Stainless steel header with butterfly valve and schedule 80 PVC tributary piping.
 - 2. NEMA 4 Compliant
 - 3. 3'-4" tall by approximately 4'-2" wide and 1'-7" deep.
 - 4. Provide 1/4" NPT Stainless Steel pressure Gauge
 - 5. Hose Bibb at top of header with vacuum breaker
 - 6. Mounted to wall above feature piping chase
 - 7. Netafim Manual PVC Slip Valve 4" dia.
- B. Controller WTS #0010-2248 NEMA 4X-12 rates
 - 1. 120V, 60HZ, GFCI 10A
 - 2. With 16 output expansion
 - 3. Surge, Suppressor,
 - 4. Wall-Mounted above Manifold
 - 5. 24V connection between vales in manifold and controller.
 - 6. Flow and Pressure control via Netafim valve control.
- C. Activator Power Posts (two (2) required)
 - 1. T304 Stainless steel base
- D. FS Poly Palm Cocco (0010-3555) catalog number
 - 1. One (1) Required

2. T-304 Stainless Steel Base
 3. Polypropylene bucket
 4. 8 gpm
 5. 10'-3" tall with 4'-0" dia
- E. FS Poly Palm (0010-3555) catalog number
1. Two (2) required
 2. 9'-10" tall with a 4'-8" diameter
 3. T-304 Stainless Steel Base
 4. 5 gpm
- F. FS Surf Cannon (0010-1457) Catalog Number
1. Two (2) required
 2. T-304 Stainless Steel Base
 3. 1.5 gpm
 4. 3'-7" tall by 1'-6" dia
- G. FS Surfboard (0010-0949) Catalog Number
1. One (1) required
 2. T-304 Stainless Steel Base
 3. 4 gpm
 4. 7'-6" tall by 2'-6" dia
- H. GS Team Effect (0010-9816) Catalog Number
1. One (1) required
 2. T-304 Stainless Steel Base
 3. 8 gpm
 4. 10'-3" by 2'-2" ground spray (flush with grade)

- I. GS Group Volcano (0010-7495) Catalog Number
 - 1. One (1) required
 - 2. T-304 Stainless Steel Base
 - 3. 10 gpm
 - 4. 3'-4" by 3'-9" ground spray (flush with grade)
- J. FS Water "O" (0010-0369) Catalog Number
 - 1. Two (2) pair required
 - 2. T-304 Stainless Steel Base
 - 3. 6 gpm
 - 4. 7'-10" wide by 6'-6" tall
- K. FS Sky Soaker (0010-4592) Catalog Number
 - 1. One (1) required
 - 2. T-304 Stainless Steel Base
 - 3. 30 gpm
 - 4. 5'-4" wide by 17'-2" tall
 - 5. The dumping ball is to be a beach ball motif & as large as the feature will allow.
- L. FS Fellows (0010-6589) Catalog Number
 - 1. Three (3) required
 - 2. T-304 Stainless Steel Base
 - 3. 2 gpm
 - 4. 3'-0" tall
 - 5. Dolphin, Turtle & Starfish
- M. GS Pop-it (0010-7502) Catalog Number
 - 1. Seven (7) required

2. T-304 Stainless Steel Base
 3. 1 gpm ea.
 4. See plan for layout ground spray (flush with grade)
- N. FS Trilly Willy Windy (0010-1670) Catalog Number
1. One (1) required
 2. T-304 Stainless Steel Base
 3. 5 gpm ea.
 4. 10'-9" tall by 4'-5" wide
- O. FS Daisy May Windy (0010-1655) Catalog Number
1. One (1) required
 2. T-304 Stainless Steel Base
 3. 5 gpm ea.
 4. 10'-9" tall by 4'-9" wide
- P. GS Tulip (0010-7849) Catalog Number
1. Three (3) required
 2. T-304 Stainless Steel Base
 3. 6 gpm ea.
 4. See plan for layout ground spray (flush with grade)
- Q. GS Tilty Pop-it (0010-7503) Catalog Number
5. Fourteen (14) required
 6. T-304 Stainless Steel Base
 7. 1 gpm ea.
 8. See plan for layout ground spray (flush with grade)

PART 3- EXECUTION

3.01 Surface Conditions:

A. Inspection:

1. Before installing the items of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that the spray ground equipment items may be installed in strict accordance with the original design, pertinent codes and regulations, and the manufacturers' recommendations.

B. Discrepancies:

1. In the event of a discrepancy, immediately notify the City's Representative.
2. Do not proceed with installation in areas of the discrepancy until all such discrepancies are fully resolved.
3. Failure to notify the City's representative in writing of discrepancies shall constitute acceptance by the Installer of existing conditions as fit and proper to receive its Work.

3.02 Installation:

A. Supply and install items of spray ground equipment in strict accordance with pertinent codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use. Coordinate with other trades to ensure all embedded items are set plumb and flush. Railing ends must have anchor sockets and escutcheon plates. Be certain that deck equipment and railings are properly bonded before embedding.

B. Coordinate Manufacturer's required bases with each feature per instructions.

3.03 Instruction:

A. Upon final inspection and review by the City's representative, carefully instruct the City's maintenance and operations personnel in the proper operation and maintenance of installed equipment.

END OF SECTION 13 15 10

SECTION 13 15 20

SWIMMING POOL MECHANICAL EQUIPMENT

PART 1 – GENERAL

- 1.01 Division 1 and the General Conditions apply to all Work of this Section.
- 1.02 Description:
- A. Work Included:
Provide labor, materials, and equipment required to install swimming pool mechanical equipment as detailed on the Drawings and herein specified.
- 1.03 Quality Assurance:
- A. All Work of this Section shall be performed by the swimming pool contractor/subcontractor.
 - B. References:
 - 1. Reference
 - C. Qualifications of Workers:
 - 1. The contractor/subcontractor for this portion of the Work shall have been successfully engaged in the business of swimming pool mechanical equipment for at least five (5) years immediately before the commencement of this Work and shall demonstrate upon review of the City's representative that its' record of workmanship is satisfactory.
 - 2. For actual construction operations, use only thoroughly trained and experienced workers who are completely familiar with the specified materials and methods.
 - 3. Provide at least one person who shall be present during the execution of this portion of the Work, thoroughly familiar with the materials and methods specified, and who shall direct all Work performed under this Section.
- 1.04 Submittals and Substitutions:
- A. Provide submittals in conformance with requirements of Section 01 3000.
 - B. Requests for substitutions shall be submitted in conformance with requirements of Section 01 60 00.
- 1.05 Product Handling:
- A. Delivery: Deliver materials to the Project Site in the Manufacturer's original unopened containers with all labels intact and legible.
 - B. Storage: Store materials undercover to prevent damage and contamination, and store only the specified materials at the Project Site.
 - C. Protection: Use all means necessary to protect swimming pool mechanical equipment

before, during, and after installation and to Work installation all other trades.

- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary upon review of the City's representative.

PART 2 – PRODUCTS

2.01 Recirculation Pump with Strainer - Pentair EQK-500 NEMA rated premium efficiency, three-phase pool pump with integral strainer, and Pentair Acudrive VFD of same horsepower rating. 575 volts, 5.1 amps, 5 HP, NSF listed, self-priming centrifugal Pump. 6" influent and 4" effluent. Motor class "F" rated at 60TDH, 160 GPM, and seismically restrained on the equipment pad.

2.02 VFD, Pentair Commerical Acu Drive XS VF matches the selected pump motor. NEMA 12 rated. Model # AD050-5753-N12. 3=Phase, fused disconnect, on-site startup, and battery backup. Password-protected lockout and manual bypass with password invocation. Provide flow sensor kit for 6" dia influent #97016-42016KIT and provide the 6-year service warranty AD-EWW272 all in NEMA Rated 12 enclosure. Wall-mounted per manufacturers' recommendations.

A. The controller shall be one complete integrated control system capable of providing a constant flow rate to the pool by automatically controlling the circulation pump motor speed throughout all phases of the filtration cycle, including normal filtration, backwash, and slow down periods. The unit shall meet the following requirements;

1. The unit shall be sized to meet the circulation pump horsepower and operating voltage. Provide drive with a manual bypass and size for the horsepower of the Pump served.
2. The unit enclosure shall be a NEMA 12 lockable enclosure.
3. The unit shall be fitted with a fan and filter unit sized to provide adequate CFM and the necessary cooling of all integral components.
4. The unit shall be fitted with a type L door-mounted circuit breaker disconnect.
5. The unit shall be fitted with an Adjustable frequency drive with a graphics display terminal.
6. The PUMP CONTROL shall be fitted with a control circuit transformer
7. The PUMP CONTROL shall be fitted with an optimized drive reactor 3% impedance; UL listed, voltage, and horsepower rated.
8. The unit shall be fitted with a programmable digital time clock. The time clock shall have a minimum of (8) ON and (8) OFF operations.
9. The PUMP CONTROL shall be fitted with a programmed logic control PLC.
10. The PUMP CONTROL shall be fitted with (2) magnetic contactors.
 - a. Drive output contactor

- b. Bypass output contactor
11. Operation:
 12. The PUMP CONTROL shall be capable of operating in a minimum of (7) different modes. These modes shall be easily accessible to the operator via a panel-mounted selector switch. Changing modes shall not require any additional adjustment or programming.
 13. The different modes of operation shall be:
 - a. By-Pass: Full across the line starting that bypasses the variable drive functions. Motor protection is provided through the overload block
 - b. Off: selector switch position to turn of circulation pump when cleaning inlet strainer basket or to perform other routine maintenance.
 - c. Automatic: Provides complete automatic operation of the circulation pump during all operational phases. The PUMP CONTROL shall maintain the normal filtration flow rate whenever the user-supplied pump run signal is connected and powered. The pump run signal shall be either 120V or 24 VAC. The PUMP CONTROL shall automatically switch to a separate pre-set backwash speed whenever the pump run signal is active and the backwash signal is connected and becomes powered. The backwash signal shall be either 120V or 24VAC. The PUMP CONTROL shall be capable of handling different input signals from either source (mixing and matching)
 - d. Automatic plus: Provides the operation as described in item 'c' above. In addition to normal automatic operation, the PUMP CONTROL shall be capable of slowing down the circulation pump during hours of pool non-operation. The timing of the slow-down periods shall be programmed during startup by a qualified factory-trained manufacturer's representative via the digital time clock (2.08).
 - e. Normal filtration: Provides continual operation at the normal filtration flow rate.
 - f. Manual backwash: Provides continual operation at the backwash speed
 - g. Normal filtration plus: Provides operation at the normal filtration flow rate or the plus flow rate as determined by the digital time clock. The timing of the slow-down periods shall be programmed during startup by a qualified factory-trained manufacturer's representative via the digital time clock.
 14. Speeds: The PUMP CONTROL shall be capable of operating at a minimum of (3) three distinct operating speeds.
 - a. Normal Filtration Speed: This shall be a variable speed that maintains the required flow rate during normal pool operation.

- b. Plus Speed: This shall be a variable speed that maintains a reduced flow rate during times of pool non-operation.
 - c. Backwash Speed: This pre-set speed shall match the circulation pump flow to the optimum filter backwash flow rate.
 - 15. Documentation: The authorized supplier for the PUMP CONTROL shall provide a complete instruction, operation, and maintenance manual. The instruction manual shall include installation instructions, daily operating instructions, and recommended maintenance schedule.
 - 16. Startup and training: Factory Local factory representation for the products contained herein is mandatory. A site-specific/ site-local factory-authorized and trained service specialist shall provide system startup and training. The startup shall include adjustments to the PUMP CONTROL system and all of its controlling components, calibration and setup of the control system, and instructions to the City/operator of the System's workings.
 - B. The PUMP CONTROL system shall be a PENTAIR ACU DRIVE VFD unit or reviewed equal if reviewed in advance of bidding; see General Conditions. One (1) required bypass and lockout password protection.
 - 1. Typ. Do not mount within 4' -0" of the automated controller. Also, do not mount next to the electrical service panels.
- 2.03 Feature Pump with Strainer - Pentair EQK-500 NEMA rated premium efficiency, three-phase pool pump with integral strainer, and Pentair Acudrive VFD of same horsepower rating. 575 volts, 5.1 amps, 5 HP, NSF listed, self-priming centrifugal Pump. 6" influent and 4" effluent. Motor class "F" rated at 60TDH, 200 GPM, and seismically restrained on the equipment pad.
- 2.04 VFD, Pentair Commerical Acu Drive XS VF matches the selected pump motor. NEMA 12 rated. Model # AD050-5753-N12. 3=Phase, fused disconnect, on-site startup, and battery backup. Password-protected lockout and manual bypass with password invocation. Provide flow sensor kit for 6" dia influent #97016-42016KIT and provide the 6-year service warranty AD-EWW272 all in NEMA Rated 12 enclosure. Wall-mounted per manufacturers' recommendations. (see 2.02 above similar)
- 2.05 Semi-automatic controller (CA100) and face-piping Kit Number FP-SS1-48. 2.05 Filtration System – HRS Stark Filter, SS1-48-04, providing 13.5 sf of high rate sand filtration rate. Piping includes flange gaskets and Isoplast hardware. Provide 4" Sight Glass x GRV. Spool (SP02-048B). Place air relief valve on top of the tank – Bell & Gossett hydronic air vent, ½" air relief valve all brass with manual override. Seismically restrain on the equipment pad per manufacturers instruction or as directed.
- 2.06 Boiler
- A. Manufacturer, Ray Pak, Inc.
 - 1. Contact: 2151 Eastman Ave., Oxnard, CA 93030; Telephone: (805) 278-5300; Fax: (800) 872-9725; Web site: www.raypak.com
 - 2. X94 Professional pool heater. NSF certified. With 4" CPVC venting with the

terminal. Use gravity vent on both intake and exhaust on wall externally. Provide condensate neutralizer of Manufacturer's recommended size. Provide ¾" T&P valve properly vented to outside, installed for optimum operation. 399,000 BTU. Model #SR410EN. ¾" natural gas connection with safety on/off valve at heater. Regulator to be within 6'-0" of the heater. 2" pool water influent and effluent with a minimum flow of 40 gpm and maximum of 125 gpm. Flowmeter with Fireman's shut-off interconnected with an automated controller. Seismically restrain on the equipment pad per Manufacturer's instruction or as directed with ¼" stainless-steel Titen HD screws with flat washers in tabs provided by the Manufacturer. Provide adequate space in installation to allow for maintenance and operation of the heater without its removal—the weight of heater 300 LBS.

3. Electrical requirements for the heater is 120v/1ph/60Hz, 5amps. Bond and ground heater as required by NEC 680.

2.07 Automated Controller

- A. Santa Barbara Control System, Chemtrol PC3000, microprocessor-based programmable controller with full remote operation capability. 15A.110V weight 21 lbs.
- B. An integrated electronic system shall be furnished to continuously monitor and control the pH level and chlorine residual of swimming pool water.
- B. Submittal data shall include complete documentation relating to all the specified features and include the manufacturer's sales literature, engineering drawings, and installation, operation, and maintenance manuals.
- C. The System shall be capable of monitoring and controlling pH and free available chlorine both with/without the presence of cyanuric acid.
- D. Description:
 1. The controller shall be provided in a wall-mountable corrosion-proof non-metal cabinet with a key lockable, windowed door. The display panel shall continuously indicate pool water pH and chlorine levels. NEMA4X
 2. The controller shall be provided with audible and visual high and low pH and high and low chlorine alarms. A high pH alarm shall prevent soda ash or hypochlorite feed. Low pH alarms shall prevent acid feed or gas chlorine feed. Any of these alarms shall activate a remote master alarm signal.
 3. The System shall be provided with a paddlewheel-style flow switch with a see-through cover and "on stream" light. Flow switch shall be non-corrosive, low voltage, and be designed to be incapable of failing in the "on stream" mode.
 4. The controller shall be equipped with an internal solid-state overfeed circuit that shall disable the appropriate chemical feeder(s) and energize an alarm circuit in the event of electrode failure, chemical feeder malfunction, improper valving of recirculation system, or depletion of chemical supply.
 5. The controller shall have a circuit board to connect with the internet allowing the

user to communicate with the controller from a remote location via a computer interlink – CAT VII cable.

6. Heater Control with energy saver program and Fireman's switch control
7. The entire controller shall be listed by Underwriters Laboratories Inc.(UL).
8. The controller shall carry a five-year warranty.
9. Water-Level control
10. CHEMCOM remote software and graphical display under Windows.

2.08 Chlorine Feed Pump,

A. Pool Chlorine Feed,

1. 115/230 volt; single phase; 60 Hz.; 96 GPD @ 100 PSI; furnish complete with a fiberglass shelf bracket. Stenner

2.09 Pool Acid Feed Pump,

A. Pool pH Feed,

1. 115/230 volt; single phase; 60 Hz.; 13.92 GPD @ 250 PSI; furnish complete with a fiberglass shelf bracket. Stenner

2.10 Ultra Violet Disinfection System, UV: Safeguard UV, 4" dia, Low-Pressure High-Output Amalgam UV Lamps. 80% efficient after 9,000 of continual operations. Wall-mounted on wet play cistern return. NSF approved and UL listed. 115/230 volts, .70 amps at 115v, and .35 amps at 230v. Ultraviolet Disinfection Equipment: Shall operate within the UVC electromagnetic spectrum, emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection - inactivation of bacteria, algae, molds, viruses, and destruction of Monochloramines, Trichloramines, and Dichloramines. Model #CLP61560A10. 1,560 input watts and 540 IV-C Output Watts. 6-130 Lamps at 181 gpm

- A. The U.V. System shall have a MET or equivalent (ETL, CSA, or U.L.) listing, be NSF-50 certified, including Section 13 and 3rd party validated to the USEPA UVDGM 2006 Guidelines.
 1. Equipment General Description
 - a. The Ultraviolet System shall be provided in a complete package to include: 316L Stainless Steel Chamber, Control System located in a NEMA 12 rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, strainer basket automatic wiper system, and Project Commissioning by a Certified ETS Ultraviolet Technician.
- B. ECF Units: Ultraviolet Manufacturer to offer the unit capability of a horizontal OR vertical installation application using state-of-the-art design and direct flow-through characteristics. A direct flow will be required to reduce total head loss through the System. Unit shall be a Multiple Lamp medium pressure system with a bulb range of (2) 1.0 kW – (4) 3.0 kW power range. Multiple lamp systems are required to maintain quality disinfection in the event of a single bulb failure. ANSI flange range of 4" – 12" and flow pattern of 360 to 3700 GPM. @ 95% UVT. Any systems validated or designed for flows based on 98 % UVT are not acceptable. Chamber and

Control Cabinet shall be as indicated on the drawings. Electrical requirements to include either of the following 208, 240, 480, or 575 volt 3-phase with a (XX) amp external breaker recommended by ETS based on the appropriate supply voltage. The electrical Contractor is to consider plus/minus 3% for the external breaker—all required electrical work to be performed by a licensed electrician.

- C. **ULTRAVIOLET CHAMBER:** Pressure rated for 100 psi (tested to 150 psi), and pressure drop across the unit will be minimal. The unit shall be constructed of 316L stainless steel passivated to prevent corrosion within the harsh pool environment. The Ultraviolet Chamber shall come complete with the following equipment:
1. Ultraviolet intensity monitor factory calibrated to provide intensity in mw/cm^2 , monitors providing a percentage of lamp output not acceptable. It must include a built-in alarm system to notify the operator when the output level drops below the required level of $60 \text{mj}/\text{cm}^2$ for indoor pools or $40 \text{mj}/\text{cm}^2$ for outdoor pools (or operator set dosing levels).
 2. The ultraviolet temperature control system shall be provided to maintain system integrity in the event of flow interruptions to the Chamber.
 3. Ultraviolet Chamber shall come complete with annealed quartz sleeve with "O" ring seals for water tightness.
 4. Chambers shall be complete with ANSI flanges, and all ports or vents shall be threaded NPT. The Ultraviolet Chamber must be capable of installation in the System to remain full under all conditions.
 5. The ultraviolet unit must be complete with appropriate brackets or feet for ease of installation in either vertical or horizontal mounting.
 6. The Chamber shall have a sacrificial anode attached to the Chamber, extending inside the Chamber and be bonded to the installation bond loop.
- D. **ULTRAVIOLET LAMP,** Ultraviolet lamp shall be medium pressure high intensity. The lamp shall be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. The lamp must remain unaffected by temperature variance of 0 degrees to 200 degrees Fahrenheit.
- E. The lamp system must provide a constant dose of not less than $60 \text{mj}/\text{cm}^2$ until the end of the lamp life for indoor applications and not less than $40 \text{mj}/\text{cm}^2$ for outdoor disinfection, and this must be based on monitoring the full recirculating flow rate.
- F. **AUTOMATIC WIPER SYSTEM;** An automatic cleaning system shall be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The System shall travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings shall be provided to ensure thorough quartz tube cleaning and quartz tube protection. The wiper cycle shall be user selectable and adjustable within a range of 15 minutes to 24 hours, depending on the anticipated application and deposit build-up. At a minimum, the Automatic Wiper system shall have the following characteristics:
1. The System shall utilize direct Belt Drive with square machined pulleys and shafts to prevent slippage and pin shearing.
 2. The wiper power supply shall be 24 volt D.C. for improved safety.
 3. The System shall incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.
 4. Wiper interval shall be operator selectable with an optional override switch.
 5. Wiper faults are to be indicated on the control system display.

6. Wiper System to utilize "Intelligent Operation" for automatic startup commissioning.
 - a. Records wiper position at Chamber ends. The position must be fixed and not dependent on a timed interval or component striking the end of the Chamber.
 - b. Establish a travel run without setting limit adjustments to ensure system integrity and longevity.

- G. ULTRAVIOLET CONTROL SYSTEM: Control cabinet shall be an Engineered Treatment System Touch control unit and be epoxy coated NEMA 12 rated cabinet. If mounted outdoors, they must be NEMA4X with an integral A/C unit to protect the components from the environment. Three levels of operation shall be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration. Modes of operation shall be password protected to secure system critical setup functions. The touch Control system shall have identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.
 1. Touch screen shall display a minimum of the following: Ultraviolet dose (derived from flow and intensity inputs), Ultraviolet intensity (as a % and mw/cm²), Lamp Current, Flow rate (accepts signal from optional flow meter – displayed as gallons per minute), Chamber temperature (displayed as deg. F), Operation hour meter, System spares listing, Lamp fault, low Ultraviolet & temperature alarm, Ground fault trip, Wiper fault. All alarm functions shall have a simple text message display to assist in fault finding.
 2. Touch Control system shall have a minimum of the following system interface control: Remote operation, Process interrupt features (from valves, flow meters), Low U.V. dose (configurable to shutdown or alarm only), Flowmeter input, Auto-Restrike, Half to full power Ultraviolet setting with 24 hour/7 day settable timer. Dose Pacing interface.
 3. The touch Control system shall have built-in data-logging capabilities to record the following information: Ultraviolet intensity required, Ultraviolet intensity measured, Lamp current, Chamber temperature, Flow rate (if the flow meter is connected), Time, and date stamp; all alarms generated.
 4. Touch Control system must be interfaced with a Chemistry Controller that can measure Total or Combined Chloramines to maintain the proper dosage required during the life of the lamp.
 5. Touch Control System must operate through Ethernet or Wi-Fi.
 6. Touch Control System must be capable of interfacing with a SCADA system, including Profibus and Modbus.

- H. Commissioning
 1. A qualified factory-trained technician shall commission an ultraviolet Chamber and Control Panel to institute the five-year warranty.
 2. Final electrical and control cabling will be connected from the Spectra control cabinet to the Ultraviolet disinfection chamber during the commissioning process.
 3. Daily operation and simple maintenance instructions shall be provided during the commissioning process.

2.11 Chemical Exhaust Fan,

- A. Paddock Evacuator System. 120v GFCI protected with duct package as an alternate Harrington HPC-0801 laboratory exhaust fan – 870 CFM, 110V, 60HZ, #HIPCO 401, 1/3 HP, 8" dia inlet and outlet, molded polypropylene impeller, premium quality motor. Two (2) are required. One for each chemical storage area. Seismically attached to wall or floor per Manufacturer's recommendations. Use 8" dia PVC duct to gravity vent as exhaust through the roof.

2.12 Chemical Containment,

- A. Dual Containment for 7 Gallons for dilute 10% Hydrochloric acid with fume extractor system and solid lid. Dual containment tank complying with 40CFR-264.193 Provide gas vapor neutralization. Stenner STS Chemical Solution Tank, translucent. MDLPE. Dimensions 20.5" by 37.5" Stenner pump is 45MHP2, 100 PSI .3 GPD
- B. Chemtainer Dual Containment for 30 Gallons for Sodium Hypochlorite 12.5% with a solid lid. Dual containment tank complying with 40CFR-264.193. Stenner STS Chemical Solution Tank, translucent. MDLPE. Dimensions 20.5" by 37.5" Stenner pump is 45MHP2, 100 PSI .9 GPD
- C. Seismically restrain all tanks and place all tanks on an equipment pad
- D. Justrite, 55-gallon drum capacity, 1-drum vertical (no shelf), Model No. 896270, Self Close doors, safety cabinet with drum support, exterior yellow- of 18 gauge steel. Separate cabinet for each dual containment tank. OSHA Compliant, NFPA Complaint, two doors. Color safety yellow, height 65 inches, depth 34" width 34". Each chemical storage cabinet is for only one chemical acid or chlorine—355 lbs ea. Two (2) are required, one for each chemical stored. Chemicals cannot be changed once allocated.

2.13 Automated fill,

- A. 1" dia Cla-Val with modulating float valve #428-01 (Hytrol Powertrol Main valve 100-02, CF1-C1 Float Control & CK2 isolation valve) - in stilling well. To combine with 1" FEBCO reduced pressure backflow preventer.

2.14 Emergency eyewash;

- A. wall-mounted unit. HAWS, portable wall mounted gravity-fed eyewash #7501

2.15 Flowmeter;

- A. Paddlewheel, saddle mount Flow Meter interconnected to the automated controller, Signet MK-515 flow sensor as manufactured by George Fisher or reviewed equal if reviewed in advance of bidding, see General Conditions. One (1) is required. Typically provided by automation controller (PC-2000) and blue-white gauge.

2.16 Valves:

- A. Gate Valves: PVC body, CPVC-SBR lined, Non-rising stem with position indicator, Size 1 ½ thru 14 inch – coordinate size to larger of two pipes (influent & effluent sides of the valve) Asahi or reviewed equal. (not for gas)
- B. Butterfly Valves: PVDF body, PVDF disk, Teflon seals, Lever or Gear (as shown on plans), Damper Style Butterfly Valve, water style for ANSI Flat-face Flanges. – Coordinate size to larger of two pipes (influent & effluent sides of the valve) Asahi or reviewed equally. Gear valves 6 inches and over.
- C. Check Valves: Wafer-type, epoxy coated cast or ductile iron body, 316 stainless steel plates and shaft, Viton seat material. Centerline, Metraflex, or reviewed equal.

D. Check Valve, Series 582, - 2 door wafer check valve - non-slam check Valve by Cla-Val

E. Air Release Valves (for filters) Cla-Val Series 34

2.16 Pressure Gauges:

A. 4-1/2" dial, bottom connection, chrome ring, and shut-off cock. Ranges shall be selected to indicate between mid-point and two-thirds of maximum range under design conditions. Marsh, Trerice, or reviewed equal.

2.17 Pipe Hangers and Supports:

A. General:

1. Use Kin-Line, Grinnell, Uni-strut, or reviewed equal.
2. Support all pipeline individually with hangers, each branch having at least one hanger. Lateral brace, as noted and required.
3. Support piping near the floor with steel stanchions welded to end plates secured to pipe and floor.
4. Support vertical piping at each floor level. Install coupling in piping at each support. Coupling shall rest on and transmit the load to support. Isolate copper from steel supports with vinyl electrician's tape around pipe and coupling.
5. Use Stoneman "Trisolator," Unistrut, or reviewed equal, isolators at each hanger and other support points on bare copper tubing system.
6. For PVC pipe, space hangers four (4) feet apart for pipe sizes 1" and under, five (5) feet apart for pipe sizes 1-1/4" to 2", and six (6) feet apart for pipe sizes over 2". Space hangers for horizontal pipes at a maximum of six (6) feet for copper 2" and smaller and for steel 1-1/4" and smaller; ten (10) feet for copper 2-1/2" and larger and for steel 1-1/2" and larger.
7. Size hanger rods, screws, bolts, nuts, etc., according to the Manufacturer's sizing charts.
8. Trapeze hangers may be used for parallel lines.
9. Use galvanized plated hangers, attachments, rods, nuts, bolts, and other accessories in pool mechanical room, high humidity areas, or where exposed to the weather. Hot-dip galvanize all items which are not factory furnished. Plating for hinged movements must be done at the factory.
10. Lateral Bracing: To prevent swaying of the piping systems, provide angle iron bracing and anchor into wall or overhead framing. Piping shall be braced or anchored in such a way as to resist a horizontal force of 50% of its operating weight in any direction.
11. Do not use wire or other makeshift devices for hangers.

2.20 Sleeves and Water-stops:

- A. Provide sleeves where Work of this Section passes through fire-rated partitions, floors, ceilings, concrete slabs, or exterior of the structure. Caulk clearance space using sealant appropriate for application in conformance with Manufacturer's recommendations and Title 24 of California Code of Regulations. Instead of sleeves and caulking, "Link-Seal" products may be used. 3m, Dow Corning, or reviewed equal.
- B. Provide prefabricated water-stops as indicated on the Drawings at all pipe penetrations through structures containing stored water (i.e., swimming pools, balance/surge tanks, etc.) to ensure leak-proof seals.

PART 3 - EXECUTION

3.01 Surface Conditions:

- A. Inspection:
 - 1. Before installing the items of this Section, carefully inspect the Work of other trades and verify that such Work is complete to the point where this installation can properly commence.
 - 2. Verify that swimming pool mechanical equipment can be installed in accordance with the original design and all referenced standards.
- B. Discrepancies:
 - 1. In a discrepancy, immediately notify the City's representative.
 - 2. Do not proceed with installation in areas of the discrepancy until all such discrepancies have been fully resolved.
 - 3. Failure to notify the City's representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.02 Installation:

- A. Supply and install all swimming pool mechanical equipment items in strict accordance with all applicable codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use.
- B. All equipment shall be braced and/or anchored to resist a horizontal force acting in any direction using the criteria shown on the Drawings.

3.03 Instruction:

- A. Upon final inspection and approval of the City's Representative, carefully instruct the City's maintenance and operations personnel in the proper operation and maintenance of installed equipment.

3.04 Clean-Up:

- A. Upon completion of mechanical equipment, remove all debris, materials, and equipment occasioned by this Work.

END OF SECTION 13 15 20

SECTION 22 00 00
PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 22, Plumbing Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement
 - f. Codes, Standards, Public Ordinances and Permits

2. Section 23 11 23, Facility Fuel - Natural Gas Piping and Systems

1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 1. State of California:
 - a. CALGreen - California Green Building Standards Code (CCR, Title 24, Part 11)
 - b. CBC - California Building Code
 - c. CEC - California Electrical Code
 - d. CEC T24 - California Energy Code Title 24
 - e. CFC - California Fire Code
 - f. CMC - California Mechanical Code
 - g. CPC - California Plumbing Code
 - h. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 1. ABA - Architectural Barriers Act
 2. ADA - Americans with Disabilities Act
 3. AHRI - Air-Conditioning Heating & Refrigeration Institute
 4. ANSI - American National Standards Institute
 5. ASCE - American Society of Civil Engineers
 6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 7. ASHRAE Guideline 0, the Commissioning Process
 8. ASME - American Society of Mechanical Engineers
 9. ASPE - American Society of Plumbing Engineers
 10. ASSE - American Society of Sanitary Engineering
 11. ASTM - ASTM International
 12. AWWA - American Water Works Association
 13. CFR - Code of Federal Regulations
 14. CGA - Compressed Gas Association
 15. CISPI - Cast Iron Soil Pipe Institute
 16. ETL - Electrical Testing Laboratories
 17. EPA - Environmental Protection Agency
 18. FM - FM Global
 19. IAPMO - International Association of Plumbing and Mechanical Officials
 20. GAMA - Gas Appliance Manufacturers Association
 21. HI - Hydraulic Institute Standards

22. ISO - International Organization for Standardization
23. MSS - Manufacturers Standardization Society
24. NEC - National Electric Code
25. NEMA - National Electrical Manufacturers Association
26. NFGC - National Fuel Gas Code
27. NFPA - National Fire Protection Association
28. NRCA - National Roofing Contractors Association
29. NSF - National Sanitation Foundation
30. OSHA - Occupational Safety and Health Administration
31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
32. TEMA - Tubular Exchanger Manufacturers Association
33. TIMA - Thermal Insulation Manufacturers Association
34. UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor's option, two separate submittals may be provided, consisting of underground work and building work. Deviations will be returned without review.
 3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered

during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

- a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
 - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
 - e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
 9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
 10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or

connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
 - a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
 - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - 1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
 - 2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 4) Include copy of startup and test reports specific to each piece of equipment.

- 5) Include copy of final water systems balancing log along with pump operating data.
 - 6) Include commissioning reports.
 - 7) Include copy of pressure, flow, leakage and purity test data and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
 - 8) Include copy of valve charts/schedules.
 - 9) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
 - 10) Include product certificates of warranties and guarantees.
 - 11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
 - d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
 - e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with

OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.
- I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.08 WORK INCLUDED

- A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.
- B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

- C. Hazardous Materials:
 - 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 - 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork

and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems. See Section 22 05 16 for additional information.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 22 Plumbing Sections.
- B. Piping:
 1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.
- C. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 1. Underground piping installation prior to backfilling.
 2. Prior to covering walls.
 3. Prior to ceiling cover/installation.
 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

- D. Final Punch:
1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.
 2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
 4. Organize work to minimize duration of power interruption.

3.05 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this

project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bright finished shafts, bearing housings and similar items until in service.

3.08 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.09 CLEANING

- A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - 1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
 - 2. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - 1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 DEMOLITION

- A. Confirm Demolition requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
 1. Scope:
 - a. It is the intent of these documents to provide necessary information and adjustments to plumbing system required to meet code, and accommodate installation of new work.
 - b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
 - c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
 2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
 3. Unless specifically indicated on Drawings, remove exposed, unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.
 4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.13 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document and Commissioning Reports

- B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.14 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.15 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.16 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION 22 00 00

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Flexible Pipe Connectors, Copper Piping
 2. Flexible Pipe Connectors - Gas Piping (CSA Listed)
 3. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements. Include items listed below.
- B. In addition, provide:
1. Shop drawings for review and approval by Engineer. Illustrate Design Data and Expansion Joints items below on the Shop Drawing Submittal.
 2. Design Data: Indicate selection calculations.
 3. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
 4. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.
 5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. Extra Packing for Packed Expansion Joints: One set for each joint.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Flexible Pipe Connectors, Copper Piping:
 - 1. Metraflex Company
 - 2. Mason
 - 3. Hyspan
 - 4. Or approved equivalent.
- B. Flexible Pipe Connectors - Gas Piping (CSA Listed):
 - 1. Metraflex Company
 - 2. Mason
 - 3. Hyspan
 - 4. Or approved equivalent.
- C. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping:
 - 1. Metraflex Company
 - 2. Mason
 - 3. Hyspan
 - 4. Or approved equivalent.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Inner Hose: Bronze, close pitch, annular corrugated hose.
- B. Exterior Sleeve: Braided bronze (piping over 2-inches to be 3 pound braided stainless steel).
- C. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- D. Joint: Sweat ends.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/8-inch on each side of installed center line.
- G. Basis of Design: Metraflex Model BBS.

2.03 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA OR UL APPROVED)

- A. Inner Hose: 304 stainless steel.
- B. Exterior Sleeve: Braided, 304 stainless steel.
- C. Pressure Rating: 175 PSI at 70 degrees F up to 4-inch pipe.
- D. Joint: Threaded carbon steel.
- E. Maximum Offset: 3/4-inch on each side of installed center line.
- F. Basis of Design: Mason CSAMN.

2.04 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS) - COPPER PIPING

- A. Construction: Two flexible Sections of hose and braid, two 90 degree elbows and a 180 degree return designed so piping does not change direction, but maintains course along a single axis. Use Vee Loop where space is limited. System to import no thrust loads to system support anchors or building structure.
- B. Inner Hose: Bronze, close pitch, annular corrugated hose.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- E. Joint: Sweat ends.
- F. Size: Use pipe sized units.
- G. Support: Center support at bottom of 180 degree return.
- H. Basis of Design: Metraflex Metraloop. Vee configuration Mason-Mercer VCPSB.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Expansion/Contraction Fitting Installation:
 - 1. Install expansion/contraction fittings according to manufacturer's written instructions.
 - 2. Install expansion/contraction fittings in sizes matching pipe size in which they are installed.
 - 3. Align expansion/contraction fittings to avoid end-loading and torsional stress.
 - 4. Install in accordance with EJMA (Expansion Joint Manufacturer's Association) Standards.

5. Wood structures: install expansion/contraction fittings and guides at every floor.
 6. Concrete structures: install expansion/contraction fittings and guides at interval spacing recommended by the manufacturers.
- B. Swing Connections:
1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
 2. Connect mains, risers and branch connections to equipment with at least four pipe fittings, including tee in riser.
- C. Guide Installation:
1. Install guides on piping adjoining expansion fittings and loops.
 2. Attach guides to pipe and secure to building structure.
- D. Anchor Installation:
1. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 2. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
 3. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
 4. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.
 5. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.
- E. Painting:
1. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.02 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

3.03 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED)

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

**3.04 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS),
COPPER PIPING**

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

END OF SECTION 22 05 16

SECTION 22 05 19
PLUMBING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Pressure Gauges
 - 2. Thermometers
 - 3. Thermometer Wells
 - 4. Pressure-Gauge Fittings
 - 5. Water Hammer Arrestors (Shock Absorbers)
 - 6. Trap Primers

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pressure Gauges:
 - 1. Dwyer Instruments, Inc.
 - 2. Moeller Instrument Co., Inc.
 - 3. Omega Engineering, Inc.
 - 4. Terice
 - 5. Or approved equivalent.

- B. Thermometers:
 - 1. Ashcroft
 - 2. Terice
 - 3. Weiss
 - 4. Marshaltown
 - 5. Weksler
 - 6. Or approved equivalent.

- C. Thermometer Wells:
 - 1. Ashcroft
 - 2. Omega
 - 3. Weiss
 - 4. Or approved equivalent.

- D. Pressure Gauge Fittings:
 - 1. Omega
 - 2. Weiss
 - 3. Terice
 - 4. Or approved equivalent.

- E. Water Hammer Arrestors (Shock Absorbers):
 - 1. Bellows Type:
 - a. Amtrol
 - b. J.R. Smith
 - c. Wade
 - d. Zurn
 - e. Or approved equivalent.

- F. Trap Primers:
 - 1. Wade
 - 2. Zurn
 - 3. J.R. Smith

4. PPP
5. Or approved equivalent.

2.02 PRESSURE GAUGES

- A. Pressure Gauges: ASME B40.100, phosphor-bronze bourdon type, dry type.
1. Case: Cast aluminum, stem-mounted, flange less.
 2. Size: 4-1/2-inch diameter.
 3. Window: Clear glass.
 4. Connector: Brass.
 5. Scale: White aluminum with black graduation and markings.
 6. Pointer: Black, adjustable.
 7. Mid-Scale Accuracy: One percent.
 8. Scale: PSI and KPa.
 9. Basis of Design: Trerice Model 600CB.

2.03 THERMOMETERS

- A. Thermometers - Adjustable Angle: Red or blue appearing organic liquid in glass, ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 9-inch scale.
 2. Window: Acrylic.
 3. Scale: Aluminum, white background, black graduations and markings.
 4. Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).
 5. Accuracy: 2 percent, per ASTM E 77.
 6. Calibration: 0-160 with 2 Degrees F graduations.
 7. Basis of Design: Trerice BX9.

2.04 THERMOMETER WELLS

- A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
1. Material: Brass for use in copper piping.
 2. Material: Stainless steel, for use in steel piping.
 3. Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
 4. Insertion Length: To extend to center of pipe.
 5. Cap: Threaded, with chain permanently fastened to socket.
 6. Heat Transfer Fluid: Oil or graphite.

2.05 PRESSURE-GAUGE FITTINGS

- A. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.
- B. Siphons: NPS 1/4 (DN8) coil of brass turbine with threaded ends.
- C. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.06 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Bellows-type, stainless steel casing and bellows, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

2.07 TRAP PRIMERS

- A. Trap automatic primer valve with integral anti siphon protection. Code approval required.
- B. Electronic trap seal automatic primer valve with integral anti siphon protection and timer. Coordinate quantity, locations and voltage characteristics for control points.
- C. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP PR-500.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Architect for approval prior to purchase and installation of access panel. See Section 22 00 00, Plumbing Basic Requirements for additional requirements.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Install per manufacturer recommendations.

3.02 PRESSURE GAUGES

- A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.
- B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.
- C. Install pressure gauges in piping tee with pressure gauge cock, in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

- D. Locations: Install in the following locations, and elsewhere as indicated.
 - 1. At each pump inlet and outlet.
 - 2. At inlet and discharge of each pressure reducing valve.
 - 3. At make-up water service outlets.
 - 4. At inlets and outlets of all master mixing valves.
- E. Adjust gauges to final angle, clean windows and lenses, and calibrate to zero.
- F. Install per manufacturer recommendations.
- G. Pressure Gauge Range/Graduations:
 - 1. Cold Water: 0-100 PSI; graduation 1 PSI
 - 2. Hot Water: 0-100 PSI; graduation 1 PSI

3.03 THERMOMETERS

- A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- B. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- C. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.
- D. Install per manufacturer recommendations.
- E. Thermometer Range/Graduations:
 - 1. Cold Water: 25-125 degrees F; graduation 1 degree F
 - 2. Hot Water: 30-240 degrees F; graduation 2 degrees F

3.04 THERMOMETER WELLS

- A. See "Thermometers" Article above.
- B. Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.
- C. Install per manufacturer recommendations.

3.05 PRESSURE-GAUGE FITTINGS

- A. See "Pressure Gauges" Article above.
- B. Install per manufacturer recommendations.

3.06 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201 or ASSE 1010. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.
- B. Install per manufacturer recommendations.

3.07 TRAP PRIMERS

- A. Flush supply line prior to installation.
- B. Install valve plumb using caution to not over tighten. Tightening to more than 55 ft. lbs. can damage valve and void the warranty. Do not wrench on hex.
- C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).
- D. Do not subject trap primer valve to pressure in excess of 125 PSI.

END OF SECTION 22 05 19

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Valves, General
 2. Ball Valves
 3. Butterfly Valves
 4. Swing Check Valves
 5. Backflow Prevention Assemblies
 6. Pressure Regulating Valve-Domestic Water
 7. Thermostatic Emergency Mixing Valves (ASSE 1071 Rated)

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. California Standard AB 1953 and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
 2. ISO 9001 Certified.
 3. IAPMO Certified for Low Lead.
- C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

- D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.
- B. Valves, General:
 - 1. Apollo
 - 2. Armstrong
 - 3. Cla-Val
 - 4. Milwaukee
 - 5. Mueller
 - 6. Nibco
 - 7. Red-White Valve
 - 8. Smith
 - 9. Stockham
 - 10. Tour Anderson
 - 11. Wade
 - 12. Watts
 - 13. Wilkins
 - 14. Zurn
 - 15. Or approved equivalent.
- C. Ball Valves:
 - 1. See Valves General above.
- D. Butterfly Valves:
 - 1. See Valves General above.
- E. Swing Check Valves:
 - 1. See Valves General above.
- F. Backflow Prevention Assemblies:
 - 1. Backflow Preventers:
 - a. Apollo

- b. Cla-Val
 - c. Conbraco
 - d. Watts
 - e. Zurn
 - f. Or approved equivalent.
- G. Pressure Regulating Valve-Domestic Water:
- 1. Cla-Val
 - 2. Watts
 - 3. Zurn
 - 4. Or approved equivalent.
- H. Thermostatic Emergency Mixing Valves (ASSE 1071 Rated):
- 1. Acorn Controls
 - 2. Leonard Valve
 - 3. Powers
 - 4. Guardian
 - 5. Bradley
 - 6. Or approved equivalent.

2.02 VALVES - GENERAL

- A. General:
- 1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
 - 2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
 - 3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- B. Valves in Insulated Piping: With 2-inch stem extension and following features:
- 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
 - 2. Butterfly Valves: With extended neck.
- C. Valve-End Connections:
- 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With thread according to ASME B1.20.1.
- D. Valve Bypass and Drain Connections: MSS SP-45.

- E. Building Service:
 - 1. Shutoff and Isolation Valves:
 - a. Pipe Sizes 3-inches and Smaller: Ball Valve.
 - b. Pipe Sizes 4-inches and Larger: Butterfly Valve.
 - 2. Drain Service: Ball Valves.
 - 3. Strainer Blow-Off: Ball Valve.
 - 4. Check Valves: Swing.

2.03 BALL VALVES

- A. All ball valves on brazed piping are to be three-piece.
- B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.
- C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.
- D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.04 BUTTERFLY VALVES

- A. Select lug type valves.
- B. 6-inches and Smaller: 200 PSI, ductile iron body, extended neck, stainless steel stem with stainless steel disc, reinforced resilient EPDM seat, memory stop control, lever handle through 5-inches, size and worm gear operator for 6-inches and larger. Mount stem in horizontal position. Manual lever and lock. MSS SP-58, Type 1.

2.05 SWING CHECK VALVES

- A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.
- B. 2-1/2-inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MMS SP-71.
- C. Check Valve: Horizontal installation. Working pressure to 300 PSI, Type 304/302 Stainless Steel conforming to ASTM 167. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.06 BACKFLOW PREVENTION ASSEMBLIES

- A. General: Assemblies model numbers listed below are for general comparison. Project specific model numbers to be verified contractor as approved by jurisdiction where project is located.
- B. Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications:
 - 1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1013 and AWWA C511. Bronze construction, threaded ends, stainless steel internal parts, FDA strainer, and air gap fitting. Route pipe from air gap fitting to approved waste receptor.
 - 2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C511. Epoxy coated cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and FDA strainer.

2.07 PRESSURE REGULATING VALVE-DOMESTIC WATER

- A. Water: Bronze body, diaphragm or piston type, spring actuated, with separate or integral stainless steel strainer, pressure range to suit conditions, approved for potable water use, low lead. Provide shutoff valves, pressure relief valves, unions, drain valve and bypass.

2.08 THERMOSTATIC EMERGENCY MIXING VALVES (ASSE 1071 RATED)

- A. Thermostatic type with lead-free brass or bronze construction, corrosion resistant internal components, threaded check inlets with integral screens, 0-200 degrees F dial thermometer and inlet and outlet isolation valves. Mixing valves to meet ASSE 1071.
- B. The sensor will be an advanced paraffin actuator with a temperature range of 60 degrees F to 95 degrees F, factory set to 85 degrees F. The temperature adjustment will be furnished with a lock mechanism to prevent unauthorized or accidental adjustment. Use the factory set point unless noted otherwise.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.

- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.
- D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.
- E. Purge and clean all piping to be connected to valve.
- F. Install per manufacturer's recommendations.
- G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.
- H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- I. Do not attempt to repair defective valves; replace with new valves.
- J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.
- L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.
- M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.
- N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.
- O. Seats: Renewable seats, except where otherwise indicated.
- P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.

- Q. If valve applications are not indicated on Drawings, use the following:
1. Shutoff Service: Ball or Butterfly valves.
 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
- R. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- S. Valves, except wafer/butterfly types, with the following end connections:
1. For Copper Tubing, 2-inches and Smaller. Threaded ends except where solder-joint valve-end.
 2. For Copper Tubing, 2-1/2-inches to NPS 4-inches. Flanged ends except where threaded valve-end.
 3. For Copper Tubing: 5-inches and Larger: Flanged ends.
 4. For Steel Piping, 2-inches and Smaller: Threaded ends.
 5. For Steel Piping, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
- T. Valve Adjusting and Cleaning:
1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
 2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.02 BALL VALVES

- A. See General Installation Requirements above.

3.03 BUTTERFLY VALVES

- A. See General Installation Requirements above.

3.04 SWING CHECK VALVES

- A. See General Installation Requirements above.
- B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.
- C. Ejector and Sump Pump-Discharge Check Valves:
1. 2-inches and Smaller: Bronze swing or spring-loaded lift check valves with bronze disc.
 2. 2-1/2-inches and Larger: Rubber flapper swing check valves with lever and weight.

3.05 BACKFLOW PREVENTION ASSEMBLIES

- A. See General Installation Requirements above.

- B. Install where indicated, and where required by code. Where practical, locate in same room as equipment being protected.
- C. Submit product cut sheets to local AHJ for approval prior to purchase and installation.
- D. Install as close to wall as possible with clearances for access and maintenance as required by AHJ.
- E. Coordinate exact location of installation and type of backflow device serving a particular piece of equipment with AHJ and Architect prior to purchase and installation.
- F. Provide wall/floor brackets that are of fully welded, hot dipped galvanized construction, fabricated to meet field conditions. Mount backflow preventer to brackets using cadmium plated "U" type bolts and nuts.
- G. Contact local water district/backflow specialist and request backflow installation requirements. Install backflow devices per UPC and local water district/backflow specialist requirements.
- H. Route waste piping from air gap waste fitting concealed within walls to point of air gap termination at indirect waste receptor.
- I. Follow local codes for installation requirements. Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. Provide a strainer ahead of backflow preventer to prevent disc from unnecessary fouling. Install valve in line with arrow on valve body pointing in the direction of flow. It is important that the valve be easily accessible to facilitate testing and servicing. Do not install in a concealed location.

3.06 PRESSURE REGULATING VALVE-DOMESTIC WATER

- A. See General Installation Requirements above.
- B. Install valve in the line with arrow on valve body pointing in the direction of flow. This valve should be installed where it is accessible with sufficient clearance for cleaning, service or adjustment. Install the reducing valve before a sill cock line if possible. Before installing the reducing valve hose bibb, flush out the line to remove loose dirt and scale which might damage valve disc and seat.
- C. Horizontal installation is recommended. However, valve can be installed in a vertical position. Regulator must be installed in an accessible location to facilitate servicing the regulator.
- D. To readjust reduced pressures, loosen adjusting screw nut and turn adjusting screw clockwise to raise reduced pressure and counterclockwise to lower reduced pressure.
- E. When reducing valve is used, it makes a closed system; therefore, pressure relief protection must be provided on the downstream side of the reducing valve to protect equipment.
- F. Provide pressure relief valve and terminate discharge to indirect waste receiver.
- G. Anytime a reducing valve is adjusted, the use of a pressure gauge is recommended to verify correct pressure setting. Do not bottom out adjusting screw or spring cage.

- H. Provide inlet and outlet ball valves, and globe valve bypass. Provide pressure gauge on valve outlet.
- I. Provide pressure relief valve piped full size to indirect waste receiver or floor drain.
- J. Provide factory startup on automatic control valves.

3.07 THERMOSTATIC EMERGENCY MIXING VALVES (ASSE 1071 RATED)

- A. See General Installation Requirements above.
- B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Pipe Hangers and Supports for Plumbing Piping and Equipment
 2. Wall and Floor Sleeves
 3. Building Attachments
 4. Flashing
 5. Miscellaneous Metal and Materials

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
 2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
 3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
 4. Install piping per SMACNA's requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

- A. General - Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.
 - 2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 - 1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- E. Provide seismic restraint hangers and supports for piping and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pipe Hangers and Supports for Plumbing Piping and Equipment:
 - 1. Pipe Hangers/Supports:
 - a. B-Line Systems, Inc.
 - b. Anvil International
 - c. HOLDRITE
 - d. Erico Co., Inc.
 - e. Snappitz Thermal Pipe Shield Manufacturing
 - f. Rilco Manufacturing Co. Inc.
 - g. Nelson-Olson Inc.
 - h. Or approved equivalent.

2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Anvil International, Anvit-Strut
 - c. Erico Hanger Co., Inc.; O-Strut Div.
 - d. Unistrut Corp.
 - e. HOLDRITE EZ-Strut Systems
 - f. Or approved equivalent.
 3. Thermal-Hanger Shield Inserts:
 - a. Erico Hanger Co., Inc.
 - b. Pipe Shields, Inc.
 - c. Rilco Manufacturing Co., Inc.
 - d. HOLDRITE Insulation Couplings
 - e. Or approved equivalent.
 4. Freestanding Roof Supports:
 - a. Erico Hanger Co., Inc.
 - b. Nelson-Olsen Inc.
 - c. B-Line
 - d. M. Fab
 - e. Or approved equivalent.
 5. Pipe Alignment and Secondary Supports:
 - a. HOLDRITE
 - b. Starquick
 - c. Or approved equivalent.
- B. Wall and Floor Sleeves:
1. Below Grade and High Water Table Areas:
 - a. Modular Link Sealing System at Pipe Sleeves:
 - 1) Thunderline Corporation
 - 2) Or approved equivalent.
 2. Pre-Engineered Firestop Pipe Penetration Systems:
 - a. HOLDRITE HydroFlame
 - b. Proset
 - c. Or approved equivalent.
- C. Building Attachments:
1. Anchor-It
 2. Gunnebo Fastening Corp.
 3. ITW Ramset/Red Head
 4. Masterset Fastening Systems, Inc.
 5. Or approved equivalent.

- D. Flashing:
 1. Fastenal
 2. Or approved equivalent.
- E. Miscellaneous Metal and Materials:
 1. See Miscellaneous Metal and Materials article below.

2.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:
 1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
 2. Use only one type by one manufacturer for each piping service.
 3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
 4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
 5. Provide padded pipe hangers, clamps and supports for thermoplastic piping system.
 6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.
- B. Pipe Hangers, Guides and Channel Systems:
 1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
 2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
 3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
 4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resist corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
 5. Pipe Guides:
 - a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.

6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
- C. Pipe Saddles and Shields:
1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
 2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
- D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
 2. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate.
 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
 5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
 6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.
- E. Concrete Inserts:
1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
- F. Continuous Concrete Insert:
1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
- G. Beam Clamps:
1. MSS Type 19 and 23, wide throat, with retaining clip.
 2. Universal Side Beam Clamp: MSS Type 20.
- H. Below Ground:
1. Pipe Hangers: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 316. MSS Type 1. If PVC piping to be used, provide Type 1 hanger, coated for PVC piping.
 2. Rod: 5/8-inch stainless steel Type 316.
 3. Eyebolt: Stainless steel Type 316.
 4. Nuts and Washers: Stainless steel Type 316.

- I. Hangers for Pipe Size 2-inches and Smaller:
 - 1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.
- J. Hangers for Pipe Size 2-1/2-inches and Larger:
 - 1. Adjustable clevis type, UL listed, Type 1.
- K. Riser Clamps:
 - 1. Steel, UL listed. MSS Type 8.
- L. Plumbers Tape:
 - 1. Not permitted as pipe hangers or pipe straps.
- M. Pipe Alignment and Secondary Support Systems:
 - 1. Secondary Pipe supports for general applications (Non-Acoustical).
 - a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
 - b. Supports may be used when sound and/or vibration transfer is not a concern.
 - 2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
 - a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
 - b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.
 - c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.
 - d. Support Products:
 - 1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or approved equivalent.
 - 2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or approved equivalent.
 - 3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or approved equivalent.
 - 4) Drop-Ear Fitting Support: HOLDRITE #265, or approved equivalent.
 - 5) Floor Riser Isolation Pads: HOLDRITE #275-T, or approved equivalent.
 - 6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or approved equivalent.
- N. Freestanding Roof Pipe Supports:
 - 1. Polyethylene high-density U.V. resistant quick "pipe" block with foam pad.
 - 2. Recommended installation is for pipe blocks to be freestanding.
 - 3. Piping 3-inches and larger mounted on block type supports.

2.03 WALL AND FLOOR SLEEVES

- A. Below Grade and High Water Table Areas:
 - 1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
 - 2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.
- B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.
- C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.
- D. Fabricated Accessories:
 - 1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
 - 2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
 - a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
 - b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
 - c. Sleeve Sizes 7-inches and Larger: 14 gauge.
 - d. Fire-Rated Safing Material:
 - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
 - 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.04 BUILDING ATTACHMENTS

- A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.
- B. Anchor Bolts:
 - 1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.

2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.
- C. Beam Clamps:
1. MSS Type 19 and 23, wide throat, with retaining clip.
 2. Universal Side Beam Clamp: MSS Type 20.
- D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- E. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Non-staining, noncorrosive, and non-gaseous.
 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.05 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.
- D. Provide hot dipped galvanized components for items exposed to weather.

2.06 MISCELLANEOUS METAL AND MATERIALS

- A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.
 1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather.
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.
- I. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Non-staining, noncorrosive, and non-gaseous.
 - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Examination:
 - 1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Preparation:
 - 1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Hangers and Supports:

1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
2. Pipe Ring Diameters:
 - a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
 - b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
4. Pipe Support Brackets: Support pipe with pipe slides.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - a. Field assemble and install according to manufacturer's written instructions.
7. Pipe Guides:
 - a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
10. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
11. Do not support piping from other piping.
12. Fire protection piping will be supported independently of other piping.
13. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
14. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
15. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.

16. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
17. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
18. Insulated Piping: (comply with the following)
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits according to ASME B31.9.
 - b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe, not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
 - 2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
 - 3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
 - 4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
 - 5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
 - e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
 - f. Insert Material: Length at least as long as protective shield.
 - g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
19. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.
20. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.

B. Pipe Curb Assemblies:

1. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.
2. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.

C. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
3. Riser to be supported at each floor penetration.
4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

D. Adjusting and Painting:

1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.03 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:

1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.

4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.04 BUILDING ATTACHMENTS

- A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.
- B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.
- C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
- E. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- F. Anchor Bolts:
 1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.
- G. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
- H. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.
- I. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 1. Install fabricated pipe sleeve.
 2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
- J. Piping Penetrations Through Fire-rated (1 to 3 hour) Assemblies:

1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.
- K. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.05 FLASHING

- A. Flash and counter flash where piping passes through weather or waterproofed walls, floors and roofs.
- B. Flash vent soil pipes with flashings per Division 01, General Requirements.
- C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches x 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.
- D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

3.06 MISCELLANEOUS METAL AND MATERIALS

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

- E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- F. Fabrication:
1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
 2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
 - 1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- G. Metal Fabrication:
1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
 2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
 3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:

- a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
4. Provide hot dipped galvanized components for items exposed to weather.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Plastic Nameplates
 - 2. Tags
 - 3. Plastic Pipe Markers
 - 4. Detectable Underground Tape

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:
 - 1. Equipment Type:
 - a. Identification:
 - b. Background:
 - 1) Size:
 - 2) Color:
 - c. Lettering:
 - 1) Size:
 - 2) Color:

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 - 2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.
- B. Plastic Nameplates:
 - 1. Brady Corporation
 - 2. Or approved equivalent.
- C. Tags:
 - 1. Brady Corporation
 - 2. Brimar
 - 3. Champion America Inc.
 - 4. Craftmark
 - 5. Seton Identification Products
 - 6. Or approved equivalent.
- D. Plastic Pipe Markers:
 - 1. Brady Corporation
 - 2. Brimar
 - 3. Champion America Inc.
 - 4. Craftmark
 - 5. Seton Identification Products
 - 6. Or approved equivalent.

- E. Detectable Underground Tape:
 - 1. Brady Corporation
 - 2. Brimar
 - 3. Champion American Inc.
 - 4. Craftmark
 - 5. Seton Identification Products
 - 6. Or approved equivalent.

2.02 PLASTIC NAMEPLATES

- A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/2 inch.
 - 3. Background Color: Black.
 - 4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
 - 5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.
 - 6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
 - a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
 - b. Letter Color: Red.
 - c. Letter Height: 1/2 inch.
 - d. Background Color: White.
 - e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.
- B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.
- C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.
- D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

- E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.
- F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7-inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

2.04 PLASTIC PIPE MARKERS

- A. Color: Conform to ASME A13.1 and ANSI Z535.1.
- B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.05 DETECTABLE UNDERGROUND TAPE

- A. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape with aluminum backing, minimum 6-inches wide by 4 mil thick, manufactured for direct burial service. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Lettering and Graphics:
 - 1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, 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 mechanical systems and equipment.
 - 2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

- B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.
- C. Coordination: 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.
- D. Install valve schedule at each mechanical room.
- E. Access Doors: Provide markers on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

3.02 PLASTIC NAMEPLATES

- A. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners.

3.03 TAGS

- A. Small devices, such as in-line pumps, may be identified with tags. Use metal tags on piping 3/4-inch diameter and smaller.
- B. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
- C. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- D. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.
- E. Install tags with corrosion resistant chain.

3.04 PLASTIC PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- C. For exterior underground piping installations, install underground plastic pipe markers with tracer wire 6 to 8-inches below finished grade directly above buried pipe.

- D. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

3.05 DETECTABLE UNDERGROUND TAPE

- A. For underground piping installations, Install underground plastic pipe markers with tracer wire 6-inches to 8-inches below finished grade, directly above buried pipe.

END OF SECTION 22 05 53

SECTION 22 05 93
TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Balancing water flow within distribution systems of all Division 22, Plumbing Sections, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.
 2. Adjusting plumbing systems to provide indicated quantities.
 3. Verifying that automatic control devices are functioning properly.
 4. Reporting results of the activities and procedures specified in this Section.

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Acceptable Balance Firm:
 - a. General:
 - 1) Procure services of independent Testing, Adjusting, and Balancing (TAB) agency to balance, adjust and test water circulating. Minimum Experience: 5 years.
 - b. Industry Standards: Testing and Balancing will conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:

- 1) NEBB: Comply with Procedural Standards for Testing, Adjusting Balancing of Environmental Systems.
- 2) ASHRAE: Comply with recommendations pertaining to measurements, instruments, and TAB.
- c. Test Observation: If requested, conduct tests in the presence of the Architect or the Architect's representative.
2. Provide proof of testing agency having successfully completed at least five projects of similar size and scope.
3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
4. Owner Witness: Perform tests in the presence of the Owners representative.
5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by the Authority Having Jurisdiction (AHJ), the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.
7. Do not perform TAB work until plumbing equipment has been completely installed and is operating continuously as required.
8. Conduct TAB with clean filters in place. Clean strainers prior to performing TAB.
9. Agent Qualifications: Engage a TAB Agent certified by AABC or NEBB.
10. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
 - a. Agenda Items: Include at least the following:
 - 1) Submittal distribution requirements.
 - 2) TAB plan.
 - 3) Work schedule and Project site access requirements.
 - 4) Coordination and cooperation of trades and subcontractors.
 - 5) Coordination of documentation and communication flow.
11. Certification of TAB Reports: Certify the TAB field data reports. This certification includes the following:
 - a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
12. TAB Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
13. TAB Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
14. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.

15. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
16. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.07 DEFINITIONS

- A. Adjust: To regulate fluid flow rate at the equipment.
- B. Balance: To proportion flows within the distribution system, including sub mains, branches, and terminals, according to design quantities.
- C. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- D. Report Forms: Test data sheets for recording test data in logical order.
- E. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- F. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- I. TAB: Testing, Adjusting, and Balancing.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.

- O. CTI: Cooling Tower Institute.
- P. NEBB: National Environmental Balancing Bureau.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.08 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, controls installers, and other mechanics to operate systems and equipment to support and assist TAB activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on piping distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

3.02 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - 2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of Plumbing systems and equipment.
- C. Examine equipment performance data including pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

- D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- E. Examine system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- G. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.
- H. Examine equipment for installation and for properly operating safety interlocks and controls.
- I. Examine automatic temperature system components to verify the following:
 - 1. Valves, and other controlled devices operate by the intended controller.
 - 2. Valves are in the position indicated by the controller.
 - 3. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
 - 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
- J. Report deficiencies discovered before and during performance of TAB procedures.
- K. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Isolating and balancing valves are open and control valves are operational.
- C. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - 1. Attendance is required by installers whose work will be tested, adjusted, or balanced.
- D. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

3.04 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform TAB procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation for pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including control positions, valve indicators and similar controls and devices, to show final settings.

3.05 ADJUSTMENT TOLERANCES

- A. Piping Systems: Adjust to within plus or minus 10 percent of design.

3.06 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings locations where other critical measurements were taken and cross reference location in final report.

3.07 FUNDAMENTAL PROCEDURES FOR PIPING SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 10 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare systems for TAB according to the following, in addition to the general preparation procedures specified above:
 - 1. Open manual valves for maximum flow.
 - 2. Check expansion tank liquid level, or air charge if bladder type.
 - 3. Check makeup-water-station pressure gauge for adequate pressure.

4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.08 FINAL REPORT

- A. General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into Sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
 1. Pump curves.
 2. Field test reports prepared by system and equipment installers.
 3. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 1. Title page.
 2. Name and address of TAB Agent.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB Agent who certifies the report.
 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Notes to explain why certain final data in the body of reports vary from design values.
- E. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.
 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.

- e. Model and serial numbers.
- f. Water flow rate in gpm (L/s).
- g. Water pressure differential in feet of head or PSIG (kPa).
- h. Required net positive suction head in feet of head or PSIG (kPa).
- i. Pump rpm.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.

END OF SECTION 22 05 93

**SECTION 22 07 00
PLUMBING INSULATION**

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Type 1, Glass Wool Pipe Insulation
2. Accessories

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Installer qualifications.
2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.
- B. In addition, meet the following:
 - 1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
 - 2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
 - 3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
 - 4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.07 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings".

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Type 1, Glass Wool Pipe Insulation:
 - 1. Owens-Corning
 - 2. Johns Manville
 - 3. Or approved equivalent.
- B. Accessories:
 - 1. ITW Insulation Systems
 - 2. Or approved equivalent.

2.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
 - 1. Thermal Conductivity Value: 0.27 BTU*in/(hr*sf°F) at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
 - 3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.03 ACCESSORIES

- A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION INFORMATION

- A. Verification of Conditions:
 - 1. Do not apply insulation until pressure testing and inspection of piping has been completed.
 - 2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
 - 1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
 - 2. Piping and Equipment:
 - a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

- D. Provide accessories as required. See Part 2 Article "Accessories" above.
- E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.
- G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).
- H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Hot Water Piping Above Grade (105F to 140F)	1	<1-inch	1-inch
		=>1-inch	1-1/2-inch

3.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.
- D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

3.03 ACCESSORIES

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Furnish and install accessories for all insulation types listed in this Section.

END OF SECTION 22 07 00

**SECTION 22 10 00
PLUMBING PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade and Below Grade
 2. Water Piping, Buried Within 5-feet of Building
 3. Hot and Cold Domestic Water Above Grade
 4. Condensate Piping
 5. Primer Piping
 6. Piping Specialties
 7. Cleanouts

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. NSF 61, Annex G.
 2. California Standard AB 1953.
 3. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
 4. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
 5. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
 6. Manufacturer's Standards Society (MSS) for valving and support reference standard.
 7. American Water Works Association (AWWA) for Valving Assembly Standards.
 8. American Society of Sanitation Engineers (ASSE) for Valving Standards.
 9. American National Standards Institute (ANSI) for Piping Standards.
 10. NFPA Standard 51B - "Fire Prevention in Use of Cutting and Welding Processes".

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. See component manufacturers listed in individual articles below.
- B. Cerro
- C. Charlotte
- D. Clamp-All
- E. Husky
- F. Ideal
- G. Mission
- H. Mueller
- I. Nibco
- J. Sioux Chief
- K. Spears
- L. Tyler
- M. Zurn
- N. Or approved equivalent.
- O. Cleanouts:
 - 1. J.R. Smith
 - 2. Mifab
 - 3. Sioux Chief
 - 4. Wade
 - 5. Watts

6. Zurn
7. Or approved equivalent.

P. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:

1. Hilti
2. Proset
3. Or approved equivalent.

2.02 GENERAL

- A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
- B. Manufactured materials delivered, new to the project site and stored in their original containers.
- C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.03 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE AND BELOW GRADE

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
 1. Fittings: Cast iron.
 2. Coupling Assembly:
 - a. Heavy Duty: ASTM C1540, Clamp-All Hi-Torq 125, Husky SD 4000, Mission HeavyWeight couplings.
- B. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).
 1. Fittings: PVC DWV ASTM D2665.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (primer and glue) is required.

2.04 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Copper Pipe: ASTM B88, hard drawn, Type K (A).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 2. Joints: Brazed - BCuP2.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 1. Fittings: Ductile or gray iron, standard thickness.
 2. Joints: AWWA C111/A21.11, rubber gasket with 3/4-inch diameter rods, mega lug type.

2.05 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type K (A), Drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Brazed BCuP2.
- B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.
 - 1. Fittings: ASME B16.18 copper.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.06 CONDENSATE PIPING

- A. Copper Tube: ASTM B 88 (ASTM B898M), Type L (B) or M (C).
 - 1. Fittings: ASME B16.29, wrought copper.
 - 2. Joints: ASTM B32, alloy Sn50 solder.
- B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.
- C. CPVC (Chlorinated Polyvinyl Chloride) Pipe and Fittings - Except Exterior of the Building and in Plenums and Rated Assemblies:
 - 1. Pipe and Fittings: Schedule 40, NSF-14, ASTM 439, IAPMO IS20-96, socket fittings, solvent weld.

2.07 PRIMER PIPING

- A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.
- B. Below Ground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.

2.08 PIPING SPECIALTIES

- A. Pipe Escutcheons:
 - 1. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
 - 2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
 - 3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.
- B. Low Pressure Y-Type Pipeline Strainers:

1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 percent of the working pressure of piping system with Type 304 stainless steel screens made with 1/16-inch perforations on 4-inch and smaller strainers, and 1/8-inch perforations on 6-inch and larger strainers.
 2. Threaded Ends, 2-inch and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with plus.
 3. Flanged Ends, 2-1/2-inch and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb.
- C. Air Vent with Valves:
1. Install automatic air vents in all closed and open-loop water systems at high points and at any other point necessary to free system of air. Provide shut-off valve in riser to each automatic vent valve to facilitate servicing. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings.
 2. Manufacturer: Hoffman #79.
- D. Dielectric Waterways:
1. Provide standard products recommended by manufacturers in service indicated, which effectively isolate ferrous from non-ferrous piping (eliminating electrical conductance) to prevent galvanic action and stop corrosion.
 2. Provide dielectric waterways or brass nipple fitting for transitions between dissimilar metal piping.
- E. Unions:
1. Unions to comply with the following schedule:
 - a. Black Steel, 2-inch and smaller: 150 PSI screwed malleable iron, ground joint, brass to iron seat.
 - b. Black Steel, 2-1/2-inch and larger: 150 PSI cast iron screwed flanged, flat faced, full faced gasket.
 - c. Soldered Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast bronzed or copper, ground joint, non-ferrous seat with soldered ends.
 - d. Screwed Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast brass, ground joint, brass to brass seat, threaded ends.
 - e. Flanged Copper or Brass Pipe, 2-1/2-inch and larger: Two 150 PSI cast bronze flanges.
 - f. Manufacturer: EPCO, Mueller, Stanley G. Flagg, Watts, or approved equivalent.
- F. Flexible Piping Connectors - Expansion Loops or Seismic Joints:
1. Provide flexible expansion loops of size and material noted on Drawings. Design flexible loops to impart no thrust loads on the anchors. The loop consists of two flexible sections of hose and braid, two 90 degree elbows, and a 180 degree return. Install loops in a neutral, precompressed, or pre-extended condition as required for the application. Provide drain plug for loops installed hanging down. Loops installed straight up may be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return supported.

2. Copper Pipe: Copper fittings, bronze hose and braid sweat solder ends, Metraloop Series MLS 8000.
3. Steel Pipe: Schedule 40 carbon steel fittings, stainless steel hose and braid,
4. Threaded Ends: Metraloop Series MLT 80000
5. Flanged Ends: Metraloop Series MLF 80000
6. Welded Ends: Metraloop Series MLW 80000
7. Grooved Ends: Metraloop Series MLG 80000
8. Gas Lines, CSA Approved: Metraloop - Gas MLT or MLF Series.
9. Provide expansion joints by Mason, Flexionics, or Shur Fit, for vertical and horizontal straight run hot water and domestic hot water recirculation piping exceeding 1,000-feet. Install per manufacturer's installation directions.

2.09 CLEANOUTS

- A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.
- B. Types:
 1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and standard screws.
 2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.
 3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
 4. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
 5. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
 6. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Underground Piping Systems:
 1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.
 2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
 3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.

4. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
6. Support Foundations:
 - a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.
 - b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
 - c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	Class A		Class B	
Material Passing	Min.	Max.	Min.	Max.
3/4-inch Square Opening	27	47	0	1

- d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.
7. Backfilling:
 - a. Following installation and successful completion of required tests, backfill piping in lifts.
 - 1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
 - 2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
 - b. Backfill Material:
 - 1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

- 2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
8. Compaction of Trench Backfill:
- a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - 1) Mechanical tamper,
 - 2) Vibratory compactor, or
 - 3) Other approved methods appropriate to conditions encountered.
 - b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
- B. General Installation:
1. Work performed by experienced journeyman plumbers. No exceptions.
 2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
 3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
 4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
 5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.
 - a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
 - b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
 - c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.
 - d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
 - e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.

- f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.
- g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
- h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
- i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
- j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
- k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

C. Testing:

1. General:

- a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
- b. Notify Architect and local Plumbing Inspector 2 days before tests.
- c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.

2. Testing of Pressurized Systems:

- a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

- b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
 - 3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.
- D. Corrosive Soil Conditions:
 - 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.
 - 2. Obtain and review project soils report for verification of requirements concerning corrosive soils.
- E. Protection:
 - 1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.
- F. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
 - 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- G. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.
- H. Provide joints of type indicated in each piping system.
- I. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- J. Sleeves:
 - 1. Pipe Sleeves:
 - a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
 - b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
 - c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link

sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.

- d. **Beam Sleeves:** Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 - a. Install fabricated pipe sleeve.
 - b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
 - c. Seal each end airtight with a resilient nonhardening seal per code.
3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
 - a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
 - b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.02 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE AND BELOW GRADE

- A. **Excavation and Backfill:**
 1. See 3.01 above.
- B. **Drainage, Waste and Vent Piping:** Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- C. **Corrosive Soil Conditions:**
 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
- D. **Sanitary and Storm Drainage:**
 1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
 2. **Indirect Waste or Drain Piping:** Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.

3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
4. Drains:
 - a. Install drains to suit finished floor. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
 - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
6. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.03 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Excavation and Backfill:
 1. See 3.01 above.
- B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- C. Domestic Water:
 1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
 10. Make ferrous to non-ferrous connections with dielectric fittings.
 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.

12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
13. Provide drain valves at base of risers and at low points on the system.
14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.

D. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

E. Buried Pre-Insulated Pipe Installation:

1. Installation and Testing: Install and test products in accordance with manufacturer's installation instructions.
2. Manufacturer's installation instructions are to describe the following:
 - a. Storage and handling of pipes.
 - b. Trench preparation.
 - c. Installing pipe.
 - d. Installing accessories.
 - e. Installing fittings.
 - f. Building penetrations.
 - g. Field insulation kits.
 - h. Testing.

3.04 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- B. Testing of Pressurized Systems:
 1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
 2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

- D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- F. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.
- G. Domestic Water:
1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
 10. Make ferrous to non-ferrous connections with dielectric fittings.
 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
 12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
 13. Provide drain valves at base of risers and at low points on the system.

14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.

H. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

3.05 CONDENSATE PIPING

A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

3.06 PRIMER PIPING

A. Excavation and Backfill:

1. See 3.01 above.

B. Testing:

1. See 3.01 above.

3.07 PIPING SPECIALTIES

A. Excavation and Backfill:

1. See 3.01 above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.

3.08 CLEANOUTS

- A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

END OF SECTION 22 10 00

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. General Plumbing Fixtures:
 - a. Hose Reels
 - b. Molded Resin or Stone Fixtures
 - ~~b~~.c. Shower Valves
 - ~~e~~.d. Stainless Steel Fixtures
 - ~~d~~.e. Thermostatic Mixing Valves
 - f. Trench Drains
 - ~~1~~.2. Drinking Fountains
 - ~~2~~.3. Emergency Showers/Eyewash
 - ~~3~~.4. Fixture Trim
 - ~~4~~.5. Floor Drains
 - ~~5~~.6. Floor Sinks
 - ~~6~~.7. Hose Bibbs
 - ~~7~~.8. Hub Drains

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.
 - 2. NSF 61, Annex G, Drinking Water System Components, Compliant.
 - 3. ISO 9001, Quality Management Standard Certified.
 - 4. IAPMO Low Lead Certification.
 - 5. California Standard Assembly Bill AB 1953, No-Lead Law
 - 6. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
 - 7. Items approved for use by State of California.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. "Or approved equivalent" as defined in 22 00 00, Plumbing Basic Requirements. Substitution process requirements apply to approved equivalent products.
- B. General Plumbing Fixtures: See Schedule on Drawings for type.
 - 1. Hose Reels:
 - a. Balcrank
 - b. Reelcraft
 - c. Lincoln
 - d. Or approved equivalent.
 - 2. Molded Resin or Stone Fixtures:
 - a. Fiat

- b. Mustee
- c. Stern Williams
- d. Or approved equivalent.

3. Shower Valves

- a. Delta
- b. Moen
- c. Symmons
- d. Or approved equivalent.

~~3.4.~~ Stainless Steel Fixtures:

- a. Elkay
- b. Haws
- c. Just
- d. Or approved equivalent.

~~4.5.~~ Thermostatic Mixing Valves:

- a. Bradley
- b. Powers
- c. Symmons
- ~~d. Holby~~
- ~~e.d.~~ Or approved equivalent.

~~5.6.~~ Trench Drains:

- a. Channel-Slope
- b. JR Smith
- c. PolyDrain
- d. Polycast
- e. Quazite
- f. Zurn

g. Or approved equivalent.

C. Drinking Fountains

1. Elkay
2. Haws
3. Oasis
- ~~5.4.~~ Or approved equivalent.

~~C.D.~~ Emergency Showers/Eyewash:

1. Bradley
2. Encon
3. Guardian
4. Haws
5. Speakman
6. Or approved equivalent.

~~D.E.~~ Fixture Trim:

1. McGuire
2. Dearborn Brass
3. Oatey
4. Or approved equivalent.

~~E.F.~~ Floor Drains:

1. Mifab
2. Sioux Chief
3. Smith
4. Wade
5. Watts
6. Zurn

~~F.G.~~ Floor Sinks:

1. Commercial Enameling
2. Mifab
3. Sioux Chief
4. Smith
5. Wade
6. Watts
7. Zurn
8. Or approved equivalent.

~~G.H.~~ Hose Bibbs:

1. Chicago
2. JR Smith
3. Mifab
4. Wade
5. Woodford
6. Zurn
7. Or approved equivalent.

~~G.I.~~ Hub Drains:

1. JR Smith
2. Zurn
3. Or approved equivalent.

2.02 GENERAL PLUMBING FIXTURES

- A. Review substitution request requirements in Division 01, General Requirements and 22 00 00, Plumbing General Requirements.
- B. Reference Architectural Details for mounting height and location of fixtures.

- C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each ~~typetype~~ of fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.
- E. Plumbing Fixture Thermostatic Mixing Valves:
 - 1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
 - 2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
 - 3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
 - 4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.
 - 5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

2.03 DRINKING FOUNTAINS

~~E.A.~~ See schedule on Drawings for type.

~~2.32.04~~ EMERGENCY SHOWERS/EYEWASH

- A. Provide emergency showers/eyewash products that are compliant with ANSI Z358.1, Standards for Emergency Eyewashes and Shower Equipment.

~~2.42.05~~ FIXTURE TRIM

- A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.
 - 1. Sink: McGuire 8912-C-DF.
 - 2. Lavatory: McGuire 8902-C-DF.

- B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems. Stops: T-handle or Loose Key type.
 - 1. Lavatory: McGuire LFH 2165 CK
 - 2. Sink: McGuire LFH 2167 LK
 - 3. Water Closets: McGuire
- C. Lavatory Grid Strainer: McGuire 155A.
- D. Sink Grid Strainer: McGuire 152N.
- E. Shower Grid Strainer: McGuire 1266.
- F. Sink Basket Strainer: McGuire 151.
- G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or True-bro.
- H. Escutcheons: McGuire wrought brass deep bell.
- I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

~~2.52.06~~ FLOOR DRAINS

- A. See Schedule on Drawings for types.

~~2.62.07~~ FLOOR SINKS

- A. See Schedule on Drawings for types.
- B. Plastic components are not allowed.

~~2.72.08~~ HOSE BIBBS

- A. See Schedule on Drawings for types.

~~2.82.09~~ HUB DRAINS

- A. See Schedule on Drawings for type.

PART 3 - EXECUTION

3.01 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

- A. Verification of Conditions:

1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
5. Install a stop valve in a readily accessible location in water connection to each fixture.
6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or approved equivalent. Match sealant color to fixture color.
8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
10. Replace washers or cartridges of leaking or dripping faucets and stops.
11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.
15. Do not use lead flashing.

B. Owner Furnished Equipment:

1. Rough-in and make final connections to Owner furnished equipment. Provide necessary items to complete installation.

- 2. Comply with requirements of this Section and Drawings for installation procedures.
- C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.
- D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.
- E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.
- F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.
- G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.02 DRINKING FOUNTAIN INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- ~~G.B.~~ Set plumb, level and rigid.

~~3.23.03~~ EMERGENCY SHOWERS/EYEWASH INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

~~3.33.04~~ FIXTURE TRIM INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

~~3.43.05~~ FLOOR DRAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

~~3.53.06~~ FLOOR SINK INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

~~3.63.07~~ HOSE BIBB INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

~~3.73.08~~ HUB DRAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

END OF SECTION 22 40 00

SECTION 23 00 00

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 23, HVAC Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement

- e. Owner/Contractor Agreement
- f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of California:
 - a. CALGreen - California Green Building Standards Code (CCR, Title 24, Part 11)
 - b. CBC - California Building Code
 - c. CEC - California Electrical Code
 - d. CEC T24 - California Energy Code Title 24
 - e. CFC - California Fire Code
 - f. CMC - California Mechanical Code
 - g. CPC - California Plumbing Code
 - h. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ABMA - American Bearing Manufacturers Association
 - 3. ADA - Americans with Disabilities Act
 - 4. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 5. AMCA - Air Movement and Control Association
 - 6. ANSI - American National Standards Institute
 - 7. ASCE - American Society of Civil Engineers
 - 8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
 - 9. ASHRAE Guideline 0, The Commissioning Process
 - 10. ASME - American Society of Mechanical Engineers
 - 11. ASPE - American Society of Plumbing Engineers
 - 12. ASSE - American Society of Sanitary Engineering
 - 13. ASTM - ASTM International
 - 14. AWWA - American Water Works Association
 - 15. CFR - Code of Federal Regulations
 - 16. CGA - Compressed Gas Association
 - 17. CISPI - Cast Iron Soil Pipe Institute
 - 18. EPA - Environmental Protection Agency
 - 19. ETL - Electrical Testing Laboratories
 - 20. FM - FM Global

21. GAMA - Gas Appliance Manufacturers Association
22. HI - Hydraulic Institute Standards
23. IAPMO - International Association of Plumbing & Mechanical Officials
24. IFGC - International Fuel Gas Code
25. ISO - International Organization for Standardization
26. MSS - Manufacturers Standardization Society
27. NEC - National Electric Code
28. NEMA - National Electrical Manufactures Association
29. NFPA - National Fire Protection Association
30. NFGC - National Fuel Gas Code
31. NRCA - National Roofing Contractors Association
32. NSF - National Sanitation Foundation
33. OSHA - Occupational Safety and Health Administration
34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
35. TEMA - Tubular Exchanger Manufactures Association
36. TIMA - Thermal Insulation Manufactures Association
37. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor's option, four separate submittals may be provided, consisting of

- long lead items, underground/site work, building work, and building automation system. Deviations will be returned without review.
3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
 - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection.
 - e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.
 5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
 9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
 10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable

manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

- b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
- a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
- a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - 1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
 - 2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
- a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

- 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include copy of startup and test reports specific to each piece of equipment.
 - 7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
 - 8) Include commissioning reports.
 - 9) Include copy of valve charts/schedules.
 - 10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.

- d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, equipment, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 - 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements

of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect / Engineer of any discrepancy.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 23 HVAC Sections.

B. General:

1. Earthquake resistant designs for HVAC (Division 23) equipment and distribution, i.e. motors, ductwork, piping, equipment, etc. to conform to regulations of jurisdiction having authority.
2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

C. Piping and Ductwork:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground system installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.
 - 4. After major equipment is installed.
 - 5. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:
 - 1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.
 - 2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - 1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
 - 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
 - 4. Organize work to minimize duration of power interruption.

3.05 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.
- B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.

2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.08 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.09 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.
- D. Provide miscellaneous supports/metals required for installation of equipment, piping and ductwork.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 3. See individual equipment Specifications for other painting.
 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
 6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document
 - h. Commissioning Reports

- B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.16 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

- A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and

provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION 23 00 00

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
 - 2. Wall and Floor Sleeves
 - 3. Building Attachments
 - 4. Flashing
 - 5. Miscellaneous Metal and Materials

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
 - 2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
 - 3. Install ductwork and piping per SMACNA's requirements.
 - 4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Welding:

- a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
- 2. Welding for Hangers:
 - a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
- 3. Engineering Responsibility:
 - a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.
 - 1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
- 4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
- 5. Support systems to be supplied by a single manufacturer.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

- A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
 - 2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 - 1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
 - 2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

- E. Provide seismic restraint hangers and supports for piping, ductwork and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:
 - 1. Anvil International
 - 2. B-Line Systems, Incorporated
 - 3. Erico Company, Incorporated
 - 4. Nelson-Olsen Incorporated
 - 5. Rilco Manufacturing Company, Incorporated
 - 6. Snappitz Thermal Pipe Shield Manufacturing
 - 7. Unistrut Corporation
- B. Wall and Floor Sleeves:
 - 1. Thunderline Corporation "Link Seal".
 - 2. Or approved equivalent.
- C. Building Attachments:
 - 1. Anchor-It
 - 2. Gunnebo Fastening Corporation
 - 3. Hilti Corporation
 - 4. ITW Ramset/Red Head
 - 5. Masterset Fastening Systems, Incorporated

2.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

- A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
- B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
- C. Channel Hanging System:
 - 1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60;

- screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
- D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
- E. Pipe Hangers:
1. Pipe Rings for Hanger Rods:
 - a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.
 - b. Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or approved equivalent.
 - c. Pipe hangers to have same finish as hanger rods.
- F. Pipe Saddles and Shields:
1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
 2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
- G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.
- H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resist corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
- I. Pipe Guides:
1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
- J. Pipe Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.
- K. Below Ground Pipe Supports:
1. Pipe Hangers All Sizes: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 304. MSS Type 1. Erico 406.
 2. Rod: 5/8-inch stainless steel Type 18-8.

3. Eyebolt: Stainless steel Type 18-8.
 4. Nuts and Washers: Stainless steel Type 18-8.
- L. Thermal Hanger Shield Inserts:
1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.
 2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.
 3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.
 4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
 7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.
- M. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.03 WALL AND FLOOR SLEEVES

- A. Below Grade or High Water Table Areas:
1. "Link-Seal" Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal.
 2. Provide Type S unless otherwise noted.
- B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.
- C. Fabricated Accessories:
1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
 2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:
 - a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
 - b. Sleeve Sizes 5-6-inches: 16 gauge.
 - c. Sleeve Sizes 7-inches and Larger: 14 gauge.
 - d. Fire-Rated Safing Material.
 - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.

- 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.04 BUILDING ATTACHMENTS

- A. Beam Clamps:
 1. MSS Type 19 and 23, wide throat, with retaining clip.
 2. Universal Side Beam Clamp: MSS Type 20.
- B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Anchor Bolts:
 1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
 2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.05 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.06 MISCELLANEOUS METAL AND MATERIALS

- A. General:
 1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
 2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of

welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.
- I. Grout:
 - 1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 3. Properties: Nonstaining, noncorrosive, and non gaseous.
 - 4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.
- D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-foot lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

- A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
- B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.
- C. Design hangers and supports to allow for expansion and contraction.
- D. Provide aluminum supports for aluminum ductwork.
- E. Provide stainless steel supports for stainless steel ductwork.
- F. Support vertical ducts at maximum intervals of 16-feet and at each floor.
- G. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- H. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:
 - 1. Support horizontal duct runs at not more than 4 feet intervals.
 - 2. Support vertical risers at not more than 6 feet intervals.
 - 3. Limit sag between support hangers to 1/2-inch per foot of spacing support.
 - 4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.
 - 5. Duct bends shall be not less than 1.5 duct diameter bend radius.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.
- K. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.

- L. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.
- M. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.
- N. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.
- O. Channel Support System Installation:
 - 1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - 2. Field assemble and install according to manufacturer's written instructions.
- P. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- Q. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- R. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- S. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
- T. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.
- U. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:
 - 1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.
 - 2. Use only one type by one manufacturer for each piping service.
 - 3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
 - 4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.
 - 5. Provide copper-plated hangers and supports for uninsulated copper piping systems.
- V. Plumber's Tape not permitted as pipe hangers or pipe straps.
- W. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.

- X. Pipe Ring Diameters:
 1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.
 2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
- Y. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
- Z. Pipe Support Brackets: Support pipe with pipe slides.
- AA. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
- AB. Pipe Guides:
 1. Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 2. Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
- AC. Heavy-Duty Steel Trapeze Installation:
 1. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.
 2. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- AD. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.
- AE. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
- AF. Do not support piping from other piping.
- AG. Fire protection piping will be supported independently of other piping.
- AH. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
- AI. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
- AJ. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Do not exceed pipe stress limits according to ASME B31.9.
3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe, not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
 - b. NPS 4 (DN100): 12-inches long and 0.06-inch thick.
 - c. NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
 - d. NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
 - e. NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
7. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
 - a. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

AK. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

AL. Pipe Curb Assemblies:

1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

AM. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

AN. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe.
 - a. Riser to be supported at each floor of penetration.

- b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

AO. Piping Above Roof:

1. Provide engineered roof piping supports appropriate for installation and attachment to the roof structure or structure below roof (see Architectural and Structural Drawings for roof construction, building structural systems, and sloping requirements for insulation).
2. Design a complete system unless specific details have been shown on Drawings.
3. Provide calculations signed and stamped by a Structural Engineer, registered in the State where the project is located at, as part of submittals and coordinated shop drawings.
4. Do not use freestanding supports unless approved by the Structural Engineer of Record.
5. Provide miscellaneous metal and materials as specified in Miscellaneous Metal and Materials article, above.

3.03 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
- B. Fabricated Pipe Sleeves:
 1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.
 2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
 3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
 4. Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.
- C. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 1. Install fabricated pipe sleeve.
 2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.
- D. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:
 1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

3.04 BUILDING ATTACHMENTS

- A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.
- B. Select size of building attachments to suit hanger rods.
- C. Space attachments within maximum piping span length indicated in MSS SP-58.
- D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
- H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.
- J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- K. Anchor Bolts:
 - 1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.
 - 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.05 FLASHING

- A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.

- B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.06 MISCELLANEOUS METAL AND MATERIALS

- A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
- B. Finishes:
 - 1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - 2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - 3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide

temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.

- F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
- I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
- M. Provide galvanized components for items exposed to weather.

3.07 FIRE RATED SUPPORTS

- A. Provide fire rated support as required by Codes.

END OF SECTION 23 05 29

SECTION 23 11 23
FACILITY FUEL - NATURAL GAS PIPING AND SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Fuel Pipe and Pipe Fittings - General
 - 2. Steel Pipe and Fittings, Above Grade
 - 3. Natural Gas Valves
 - 4. Gas Earthquake Valve
 - 5. Natural Gas Pressure Regulators
 - 6. Gas Solenoid Valves
 - 7. Flexible Pipe Connectors - Gas Piping (CSA Listed)

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Division 26, Electrical requirements for grounding fuel piping systems.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Fuel Pipe and Pipe Fittings - General:
 - 1. Flange Gaskets:
 - a. Buna-N (Nitrile)
 - b. NBR
 - c. Viton
 - d. Or approved equivalent.

- B. Steel Pipe and Fittings, Above Grade:
 - 1. American Piping Products
 - 2. US Steel
 - 3. Or approved equivalent.

- C. Natural Gas Valves:
 - 1. Apollo
 - 2. Jenkins Bros.
 - 3. Lunkenheimer Co.
 - 4. Nibco
 - 5. Watts
 - 6. Or approved equivalent.

- D. Gas Earthquake Valve:
 - 1. California Valve
 - 2. QuakeMaster
 - 3. Or approved equivalent.

- E. Natural Gas Pressure Regulators:
 - 1. Maxitrol
 - 2. Equimeter
 - 3. Or approved equivalent.

- F. Gas Solenoid Valves:
 - 1. ASCO Red Hat Series 8210 and 8030. Specific model numbers scheduled on Drawings.
 - 2. Or approved equivalent.

- G. Flexible Pipe Connectors - Gas Piping (CSA Listed):
 - 1. Dormont
 - 2. Proflex
 - 3. Or approved equivalent.

2.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

- A. Flange Gaskets: Gaskets to be constructed from elastomeric materials.
- B. Install per manufacturer's recommended installation requirements.

2.03 STEEL PIPE AND FITTINGS, ABOVE GRADE

- A. Steel Pipe (Above Grade Installation):
 - 1. ASTM A53, electric-resistance welded Type E, Grade B black pipe, manufactured for threaded pipe connections.
 - a. 2-inches and Smaller: Schedule 40, ASTM A53 black steel pipe and black malleable threaded fittings.
 - b. 2-1/2-inches and Larger: Schedule 40, ASTM A53 black pipe with butt weld fittings.
- B. Fittings for Steel Pipe (Above Grade Installations):
 - 1. General: Mark fittings, unions, and other products recognized as regularly available products in accordance with MSS SP-25. Marking on products of small size or shape may be omitted from sequence allowed by MSS SP-25, except for manufacturer's name or trademark.
 - 2. Threaded Fittings: Conforming to ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified or prevailing codes or requirements dictate use of 300 PSI ratings. Fittings to be fabricated from standard malleable iron with dimensions conforming to ANSI B16.3.
 - 3. Welded Fittings: Wrought carbon steel fittings, ASTM A234, ANSI B16.9, B16.28. Butt-welding type unless otherwise indicated to be socket welding type.
 - 4. Flanges: Carbon steel conforming to ASTM A105, ANSI B16.5, and factory forged in USA. Flanges which have been machined, remade, painted, or are non-domestic origin are not acceptable. Provide raised or full face ends wherever indicated or required.
 - 5. Flange Gaskets: Gaskets to be constructed from elastomeric materials.
 - 6. Flange Hardware: Bolting materials to be corrosion resistant carbon steel bolts and hex nuts conforming to ASTM A307. Provide bolting materials used in containment sumps below grade applications, stainless steel bolts and hex nuts conforming to ASTM A453. Threads and dimensions to be in accordance with ANSI B1.1 and B18.2.
 - 7. Unions: Conform to ANSI B16.39, ASTM A47 and fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads to conform to ANSI B2.1.
 - 8. Threaded Pipe Plugs: Conforming to ANSI B16.14.
 - 9. Thread Lubricant: Meet or exceed CGA ratings and compliant with Federal Specification TT-S-1732, manufactured compatible with natural gas.

2.04 NATURAL GAS VALVES

- A. 2-inches and Smaller: MSS SP-110 ball valves constructed in compliance with ASME B16.33. UL listed, FM approved, two-piece construction, threaded, bronze or brass body, full port, chrome plated brass ball, blowout-proof stem design, 125 PSI WOG working pressure.

- B. 2-1/2-inches and Larger: 100 to 125 PSI rated, all bronze or iron body/bronze trimmed plug cock type, square head or tee/lever handle operation. CSA listed.

2.05 GAS EARTHQUAKE VALVE

- A. Gas line valve providing automatic shutoff in case of earthquake. UL listed, CSA certified and FM approved. The valve or system to actuate shutoff means within 5 seconds when subjected to horizontal, sinusoidal oscillation having a peak acceleration of 0.3G (2.94 m/s²) and period of 0.4 seconds. Sensing means of valve or system not to actuate shutoff means when subjected for 5 seconds to horizontal, sinusoidal oscillations having:
 - 1. A peak acceleration of 0.4G (3.94 m/s²) with a period of 0.1 second,
 - 2. A peak acceleration of 0.08G (0.078 m/s²) with a period of 0.4 second, and
 - 3. A peak acceleration of 0.08G (0.078 m/s²) with a period of 1.0 second.
- B. Valve requires manual reset. Provide with needed spare parts to allow resetting after having been tripped. Valve to be same size as line size installed.

2.06 NATURAL GAS PRESSURE REGULATORS

- A. Natural Gas: Diaphragm and spring actuated type, with ventless or vented relief feature. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location.

2.07 GAS SOLENOID VALVES

- A. General: Solenoid bodies will be brass construction with NPT ports. The valves will be "normally closed" and pilot operated or direct acting depending on application.
- B. Electrical: 125V/1ph/60Hz.
- C. Internal Construction: Type 304 and Type 316 internal parts, elastomeric seals and lubricants as appropriate for gas service.

2.08 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED)

- A. Inner Hose: Type 304 stainless steel.
- B. Exterior Sleeve: Braided, Type 304 stainless steel.
- C. Pressure Rating: 175 PSI at 70 degrees F up to 4-inch pipe.
- D. Joint: Threaded carbon steel.
- E. Maximum Offset: 3/4-inch on each side of installed center line.
- F. Flexible Connectors: Flexible connectors used in LP and LPG piping systems compliant with following:

1. Install in accordance with manufacturer's instructions.
2. Flexible connectors and hose used as flexible connectors not exceed 3-feet in length where used with liquid or vapor piping on portable or stationary tanks.
3. Hose permitted to be used if flexibility is required for liquid or vapor transfer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Inspection: Examine areas and conditions under which fuel systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Identification: Install mechanical identification in accordance with Section 22 05 53, Identification for Plumbing Piping and Equipment.
- C. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare piping connections to equipment with flanges or unions.
- F. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
- G. Install piping systems in accordance with manufacturer's instructions.
- H. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- I. Install piping to conserve building space and avoid interference with use of space.
- J. Sleeve pipe passing through partitions, walls, and floors.
- K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- L. Provide piping mains, branches and runouts installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Provide stresses within allowable limits of ANSI B31.1 for pressure piping.
- M. Equipment Connections: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions. Flexible connections where required per ASCE 7-16 or shown on Drawings.
- N. Piping Tests: Test natural gas piping in accordance with applicable mechanical code requirements, ANSI B31.2, and local utility requirements at a minimum of 100 psig for 24 hours.

3.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

- A. Black Steel: See 3.01 General Installation Requirements above and install per local code pressure test system to 100 psig for 24 hours.
- B. Fuel Piping Installation:
1. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each route with a minimum of joints and couplings, but with adequate and accessible unions or flanges for disassembly, maintenance, and replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance. Comply with ANSI B31.9 Code for Pressure Piping. Provide shutoff valves, pressure regulators and unions at connections to gas-fired equipment. Provide dirt legs at low points.
 2. Installed piping not to interfere with maintenance of equipment, opening of doors or other moving parts nor be directly above or near any portion of electrical equipment.
 3. Support piping such that connected equipment does not bear weight of piping.
 4. Adequately support vertical lines at their bases or by suitable hanger placed in horizontal line near riser or, preferably, by base fitting set on a pedestal.
 5. Piping Through Roof: Coordinate roof penetrations prior to installation of piping. Coordinate location with roof structure and roof mounted equipment.
 6. Ream steel pipes after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods for opening and closure.
 7. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
 8. Threading: Thread steel pipe in accordance with ANSI B21.1 with standard right hand threads. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or proper pipe joint tape where recommended by pipe/fitting manufacturer on male threads at each joint and tighten joint to leave not more than three threads exposed.
 9. Sealants: Use sealants on metal fuel piping threads which are chemically resistant to fuel. Use sealants sparingly and apply only to male threads of metal joints.
 10. Maintain electrically continuous piping system; provide grounding jumper where required to maintain continuity. Provide grounding connection; install per requirements of Division 26, Electrical.
 11. Install dirt legs in gas piping where indicated and where required by code or regulation. Do not rest dirt leg on surface of roof, floor or deck.
 12. Support gas piping above roof on preformed pipe stands. Guide pipes with clamp one size larger than pipe. Provide supports at intervals per code manufacturer, and details and at each change in direction. Wood blocks are not approved supports.
 13. Gas Regulator Vent Piping: Provide Schedule 40, A53 black steel pipe and threaded black malleable threaded fittings for vent piping. Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

14. Piping: Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

3.03 STEEL PIPE AND FITTINGS, ABOVE GRADE INSTALLATION

- A. See 3.01 General Installation Requirements above and install per current version of manufacturer's installation guidelines. Test system in accordance with requirements of local code and ANSI LC-1.

3.04 NATURAL GAS VALVE INSTALLATION

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces and weld ends.
 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Do not attempt to repair defective valves; replace with new valves.
- D. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.
- E. Locate gas valves where easily accessible and protected from possible damage.

3.05 GAS EARTHQUAKE VALVE INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions and approved submittals.
- B. Install earthquake valves per manufacturer's installation requirements. In a multi-building campus setting, provide a gas earthquake valve at each building gas point of entry whether shown on drawings or not.
- C. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.
- D. Locate gas valves where easily accessible and protected from possible damage.

3.06 NATURAL GAS PRESSURE REGULATORS INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions and approved submittals.
- B. Vent regulators to outdoors as required.

- C. Pressure Regulating Valves: Install as required at gas-fired appliances; comply with utility/code requirements. Pipe atmospheric vent to outdoors, full size outlet with 90 degree elbow downturn. Install gas shutoff valve upstream of each pressure regulating valve. Install in accordance with manufacturer's instructions to prevent freezing.

3.07 GAS SOLENOID VALVES INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions and approved submittals.
- B. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.
- C. Locate gas valves where easily accessible and protected from possible damage.

3.08 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED) INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions and approved submittals.

END OF SECTION 23 11 23

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Ductwork, Joints and Fittings
 - 2. Ductwork Joint Sealers and Sealants

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Welding Certificates
 - 2. Field Quality Control Reports

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.01 DUCTWORK, JOINTS AND FITTINGS

- A. Manufacturers:
 - 1. Ductmate
 - 2. Lindab Inc.
 - 3. Nexus Inc.
 - 4. SEMCO
 - 5. United McGill Corporation
 - 6. Ward Industries
- B. Materials:
 - 1. Stainless Steel: Fabricated in accordance with ASTM A167 and A480 with liquid-tight joints when containing condensate vapor or liquids in suspension.
- C. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
 - 3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- D. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.
 - 1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
 - 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.
- E. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
- F. 90-Degree Tees and laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.
- G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
 - a. Ducts 3- to 36-inches in Diameter: 0.034-inch .
 - b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
 - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
 - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
 - b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
 - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
 - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
 4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 5. Round Elbows:

- a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
 - b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 - c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
- 6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
 - 7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
 - 8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
 - 9. Not acceptable:
 - a. Corrugated or flexible metal duct.
 - b. Adjustable elbows.

2.02 DUCTWORK JOINT SEALERS AND SEALANTS

- A. Manufacturers:
 - 1. Ductmate
 - 2. Duro Dyne
 - 3. Hardcast
 - 4. United McGill Corporation
 - 5. Vulkem
 - 6. Foster
 - 7. Childer
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
- C. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
- D. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.
- E. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
- F. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.

- G. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
- H. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- I. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Combustion Air Duct	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	3	6

- B. Ductwork Installation:
 1. General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
 2. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.
 3. Install ducts with fewest possible joints.
 4. Install fabricated fittings for changes in directions, size, shape, and for connections.
 5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
 6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.
9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
11. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and AHJ, including sleeves, and firestopping sealant.
12. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
13. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
14. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.

C. Flanged Take-Offs:

1. Install at branch takeoffs to outlets using round or flex duct.
2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:

1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.02 DUCTWORK, JOINTS AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:

1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Combustion Air Duct	Single Wall, Type 304 Stainless Steel

B. Ductwork Installation:

1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.

2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.03 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

A. Joints and Seam Joint Sealing:

1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
3. Seal ducts before external insulation is applied.
4. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
5. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
6. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
7. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
8. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
9. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
10. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION 23 31 00

SECTION 23 51 00
BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Gas-Fired Equipment Vents

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. ASTM C 401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories, current edition.
 - 2. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association, current edition.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.
 - 2. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations.
 - 3. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.
 - 4. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.
 - 5. Submit venting system design and calculations.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 DEFINITIONS

- A. Breeching: Vent connector.
- B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.
- C. Smoke Pipe: Round, single wall vent connector.
- D. Vent: That portion of venting system designed to convey flue gases directly outdoors from vent connector or from an appliance when vent connector is not used.
- E. Vent Connector: That part of venting system that conducts flue gases from flue collar of an appliance to chimney or vent, and may include draft control device.

1.08 DESIGN REQUIREMENTS

- A. Factory built vents and chimneys used for venting natural draft appliances comply with NFPA 211 and be UL listed and labeled.
- B. Selected condensing boiler or condensing gas equipment manufacturer to design and select venting system (intake and relief) per CMC and NFPA 211.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Gas-Fired Equipment Vents:
 - 1. Positive Pressure Vent:
 - a. Selkirk Corporation
 - b. Security Chimney/DuraVent
 - c. Or approved equivalent.

2.02 GAS-FIRED EQUIPMENT VENTS

- A. Positive Pressure Factory Built/85 Plus Percent Efficient Equipment:

1. Double-walled insulated piping system. UL listed. Category II, III, and IV appliances. Construction to match manufacturer required flue rating. Inner wall minimum 0.035-inch-thick AL29-4C stainless steel. Outer wall minimum 0.025-inch-thick aluminized steel. Provide minimum 1-inch space between the inner and outer walls. List system by UL as 1400F Factory Built Chimneys with 2-inch clearance to combustibles for use with No. 2 fuel oil-fired equipment. Manufacturer system to join sections, sealing gastight up to minimum 60-inch wg for temperatures up to 600F. Fittings, roof penetrations, thimbles supports, etc. of same manufacture and construction as straight sections.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's written instructions and guidelines.
- B. Install in accordance with NFPA 54.

3.02 GAS-FIRED EQUIPMENT VENTS

- A. General: Vent-type to match equipment manufacturer requirements: Category 4. Maintain clearances to combustible materials per code; double-wall, insulation, thimbles, etc. at reduced clearance locations as necessary. Vent termination clearances from buildings, building openings, ventilation intakes, etc. per code.
- B. Pressurized Gas-Fired Vents:
 1. Install venting in accordance with the manufacturer's recommendations and the requirements of the UL listing of the system. Concentric vent/intake systems to be installed per manufacturer's recommendations, minimum 12 inches above snow level.
 2. Maintain slope of vent per manufacturer's recommendations. Clearances to other buildings, openings, intakes, etc. per code unless otherwise indicated.

END OF SECTION 23 51 00

SECTION 26 00 00
ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement

- f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of California:
 - a. CALGreen - California Green Building Standards Code (CCR, Title 24, Part 11)
 - b. CBC - California Building Code
 - c. CEC - California Electrical Code
 - d. CEC T24 - California Energy Code Title 24
 - e. CFC - California Fire Code
 - f. CMC - California Mechanical Code
 - g. CPC - California Plumbing Code
 - h. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process
 - 7. ASTM - ASTM International
 - 8. CFR - Code of Federal Regulations
 - 9. EPA - Environmental Protection Agency
 - 10. ETL - Electrical Testing Laboratories
 - 11. FCC - Federal Communications Commission
 - 12. FM - FM Global
 - 13. IBC - International Building Code
 - 14. IEC - International Electrotechnical Commission
 - 15. IEEE - Institute of Electrical and Electronics Engineers
 - 16. IES - Illuminating Engineering Society
 - 17. ISO - International Organization for Standardization
 - 18. MSS - Manufacturers Standardization Society
 - 19. NEC - National Electric Code
 - 20. NECA - National Electrical Contractors Association
 - 21. NEMA - National Electrical Manufacturers Association

- 22. NETA - National Electrical Testing Association
- 23. NFPA - National Fire Protection Association
- 24. OSHA - Occupational Safety and Health Administration
- 25. UL - Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 - 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
 - a. Provide separate submittals for power system study (per Specification Section 26 05 73) and electrical equipment (for example, switchboards and panelboards).
 - b. Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings.
 - 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
 - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided.

Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.

- c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams.

Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.

- a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
 13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - b. Resubmit for review until review indicates no exception taken or "make corrections as noted".
 14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include commissioning reports.
 - 7) Include copy of startup and test reports specific to each piece of equipment.
 - 8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
 - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.

- c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
 - d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.

1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material

complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

- F. Plenums:
 - 1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
- G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.
- B. General:
 - 1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
 - 3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
 - 4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
 - 5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.

4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
 - a. Organize work to minimize duration of power interruption.
 - b. Coordinate utility service outages with utility company.

3.05 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section

will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
 2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bus duct and similar items until in service.

3.08 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to

satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.09 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
 - 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Cleaning
 - b. Operation and Maintenance Manuals
 - c. Training of Operating Personnel
 - d. Record Drawings
 - e. Warranty and Guaranty Certificates
 - f. Start-up/Test Document and Commissioning Reports

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION 26 00 00

**SECTION 26 05 09
EQUIPMENT WIRING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition:
 - 1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.02 GENERAL

- A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
 - 1. 3/4 HP and Under: 120 volt, 1 phase.
 - 2. 1 HP and Less than 5 HP Loads: 480 volt, 3 phase.
 - 3. 5 HP and Over: 480 volt, 3 phase.
- B. Safety Switches: Provide as required by CEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
 - 1. Division 21, Fire Suppression
 - 2. Division 22, Plumbing
 - 3. Division 23, HVAC, Heating, Ventilating and Air Conditioning
 - 4. Division 27, Communications
 - 5. Division 28, Electronic Safety and Security

3.02 INSTALLATION

- A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.
- B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
- C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
- D. Install motor starters and controllers for equipment furnished by others.
- E. Appliance/Utilization Equipment:
 - 1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.
 - 2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 01, General Requirements.

3.04 SYSTEMS STARTUP

- A. Provide field representative to prepare and start equipment.
 - 1. Test and correct for proper rotation of polyphase motors.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION 26 05 09

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Lugs and Pads
 - 2. Wires and Cables
 - 3. Connectors

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Cable insulation test reports in project closeout documentation.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Lugs and Pads:
 - 1. Anderson
 - 2. IlSCO
 - 3. Panduit
 - 4. Thomas & Betts
 - 5. 3M
 - 6. Or approved equivalent.

- B. Wires and Cables:
 - 1. General:
 - a. General Cable
 - b. Okonite
 - c. Southwire
 - d. Encore Wire
 - e. Or approved equivalent.
 - 2. Metal Clad Cable - Type MC:
 - a. Alflex
 - b. AFC
 - c. General Cable
 - d. Southwire
 - e. Encore Wire
 - f. Or approved equivalent.

- C. Connectors:
 - 1. Anderson Power Products
 - 2. Burndy
 - 3. IlSCO
 - 4. 3M
 - 5. Thomas & Betts
 - 6. Or approved equivalent.

2.02 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.
- B. Copper Pads: Drilled and tapped for multiple conductor terminals.
- C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.03 WIRES AND CABLES

- A. Building Wires:
 - 1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.
- B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.
- C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE	480 VOLT
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray or White w/colored strip
Ground	Green	Green

- D. MC Cable:
 - 1. Standard: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWN-2, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.
- E. AC Cable (Armored Cable): Not allowed.
- F. NMB Cable: Not allowed.

2.04 CONNECTORS

- A. Split bolt connectors not allowed.
- B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer instructions and CEC.
- B. Field Quality Control:
 - 1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures.

Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.02 LUGS AND PADS

- A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.
- B. Use torque wrench to tighten per manufacturer's directions.

3.03 WIRES AND CABLES

- A. General:
 1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F). All wire and cable must be acclimated to temperatures above freezing for no less than 24 hours prior to installation.
 2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 3. Install conductors with care to avoid damage to insulation.
 4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
 6. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12 AWG unless otherwise shown.
 - b. Provide required conductors for a fully operable system.
 - c. Power Circuits: No. 12 AWG minimum, except as follows:
 - 1) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
 - 2) No. 8 AWG for 20A, 120V circuits longer than 100 ft.
 - d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.
 7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits and all 277V circuits.

- B. Conductors in Cabinets:
 - 1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
 - 2. Tie and bundle feeder conductors in wireways of panelboards.
 - 3. Hold conductors away from sharp metal edges.

- C. Homeruns:
 - 1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
 - 2. MC cable homeruns are not allowed unless indicated on drawings.

- D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

- E. Exposed cable is allowed in the following locations:
 - 1. Exterior of Swim Center Building for new feeder to new Pump Building

- F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

- G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

- H. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.
 - 1. 20 amp branch wiring where following conditions apply:
 - a. Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to, and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted.
 - b. MC cable may be routed in the void space above hard lid ceilings, and routed within wall cavities below glazing, provided CEC requirements are otherwise met, and a minimum one 0.75-inch conduit is routed from nearest accessible ceiling space to inaccessible location, terminating in a j-box with blank faceplate, for future circuits.

3.04 CONNECTORS

- A. Install to assure a solid and safe connection.

- B. Select hand twist connectors for wire size and install tightly on conductors.
- C. Install compression connectors using methods and tools recommended by the manufacturer.
- D. Do not install stranded conductors under screw terminals unless compression lugs are installed.
- E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Grounding Electrodes
 - 2. Connectors and Accessories
 - 3. Grounding Busbar
 - 4. Grounding Conductor

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Test reports of ground resistance for service and separately derived system grounds.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Comply with the requirements of ANSI/NFPA 70.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Grounding Electrodes:
 - 1. Erico
 - 2. Thomas & Betts
 - 3. Talley
 - 4. Or approved equivalent.

- B. Connectors and Accessories:
 - 1. Burndy Hyground Compression System
 - 2. Erico/Cadweld
 - 3. Amp Ampact Grounding System
 - 4. Pipe Grounding Clamp:
 - a. Burndy GAR Series
 - b. O Z Gedney
 - c. Thomas & Betts
 - d. Or approved equivalent.

- C. Grounding Busbar:
 - 1. Chatsworth
 - 2. Erico
 - 3. Schneider Electric/Square D
 - 4. Panduit
 - 5. Or approved equivalent.

- D. Grounding Conductor
 - 1. General Cable
 - 2. Okonite
 - 3. Southwire
 - 4. Or approved equivalent

2.02 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.03 CONNECTORS AND ACCESSORIES

- A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.

- B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.04 GROUNDING BUSBAR

- A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.05 GROUNDING CONDUCTOR

- A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.
- B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Verify site conditions prior to beginning work.
- B. Bond Sections of service equipment enclosure to service ground bus.
- C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.
- D. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- E. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- F. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.
- G. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.
- H. Inspect and test in accordance with NETA Standard ATS, Except Section 4.
- I. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.02 GROUNDING ELECTRODES INSTALLATION

- A. Ground Rod Electrode:

1. Verify that final backfill and compaction have been completed before driving rod electrodes.
 2. Bond #6 grounding electrode conductor to driven ground rods as indicated on Drawings.
 3. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.
- B. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.
- C. Other Metal Piping Systems: Bond gas piping system, fire sprinkler piping system and other metal piping systems to service equipment ground bus or to the grounding electrode system.
- D. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.

3.03 CONNECTORS AND ACCESSORIES INSTALLATION

- A. Install per manufacturer's instructions.

3.04 GROUNDING BUSBAR INSTALLATION

- A. Install per manufacturer's instructions.

3.05 GROUNDING CONDUCTOR INSTALLATION

- A. Raceways:
1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.
 2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.
 3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
 4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.
- B. Feeders and Branch Circuits:
1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
 2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.

- C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.
- D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.
- E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Anchors, Threaded Rod and Fasteners
 - 2. Support Channel, Hangers and Supports

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
 - 2. Support systems to be supplied by a single manufacturer.
 - 3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
 - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
 - 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of California.
 - 1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
- D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
- E. Provide seismic restraint hangers and supports for conduit and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Anchors, Threaded Rod and Fasteners:
 - 1. Anchor It
 - 2. Epcon System
 - 3. Hilti-Hit System
 - 4. Power Fast System
 - 5. Or approved equivalent.
- B. Support Channel, Hangers and Supports:
 - 1. B-Line
 - 2. Kindorf
 - 3. Superstrut

4. Unistrut
5. Or approved equivalent.

2.02 ANCHORS, THREADED ROD AND FASTENERS

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchors and Fasteners:
 1. Do not use powder-actuated anchors.
 2. Concrete Structural Elements: Use precast inserts.
 3. Steel Structural Elements: Use beam clamps.
 4. Concrete Surfaces: Use self-drilling anchors.
 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 6. Solid Masonry Walls: Use expansion anchors.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood Elements: Use wood screws.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.03 SUPPORT CHANNEL, HANGERS AND SUPPORTS

- A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 1. Channel Material: Carbon steel.
 2. Coating: Hot dip galvanized.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: 90 lb. test with steel hooks.
- D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.

1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Fabrication - Miscellaneous Metals
 1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
 2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.02 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

- A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.
- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per CBC requirements.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Use spring lock washers under fastener nuts for strut.
- I. Cutting and Drilling
 - 1. Do not drill or cut structural members without prior permission from Architect.

3.03 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- C. Verify mounting height of luminaires prior to installation when heights are not detailed.
- D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
- F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
- G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- I. Do not use supports or fastening devices to support other than one particular item.

- J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by CEC.
- K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by CEC.
- L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by CEC.
- M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by CEC.
- N. Maximum distance between supports for rigid PVC conduits unless otherwise required by CEC is as follows:
 - 1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
 - 2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
- O. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- P. Provide seismic bracing per CBC requirements.
- Q. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- R. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- S. Wet and Damp Locations:
 - 1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Rigid Metal Conduit (RMC)
 - 2. Electrical Metallic Tubing (EMT)
 - 3. Flexible Metal Conduit (FMC)
 - 4. Liquidtight Flexible Metal Conduit (LFMC)
 - 5. Electrical Polyvinyl Chloride (PVC) Conduit
 - 6. Conduit Fittings

- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on Drawings and described in these Specifications.

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

- B. In addition, reference the following:
 - 1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
 - 2. Section 26 05 34, Boxes
 - 3. Section 26 05 43, Electrical Vaults and Underground Raceways

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.07 DEFINITIONS

- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Rigid Metal Conduit (RMC):
 - 1. Allied Tube & Conduit
 - 2. Beck Manufacturing Inc.
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- B. Electrical Metallic Tubing (EMT):
 - 1. Allied Tube & Conduit
 - 2. Beck Manufacturing WL
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- C. Flexible Metal Conduit (FMC):
 - 1. AFC Cable Systems Inc.
 - 2. Electri-Flex Company
 - 3. International Metal Hose
 - 4. Or approved equivalent.
- D. Liquidtight Flexible Metal Conduit (LFMC):
 - 1. AFC Cable Systems Inc.
 - 2. Electri-Flex Company
 - 3. International Metal Hose
 - 4. Or approved equivalent.
- E. Electrical Polyvinyl Chloride (PVC) Conduit:
 - 1. AFC Cable Systems Inc.

2. Electri-Flex Company
3. International Metal Hose
4. JM Eagle
5. Or approved equivalent.

F. Conduit Fittings:

1. Bushings:
 - a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
 - 1) Thomas & Betts 1222 Series
 - 2) O-Z Gedney B Series
 - 3) Or approved Equivalent.
2. Raceway Connectors and Couplings:
 - a. Thomas & Betts Series
 - b. O-Z Gedney Series
 - c. Or approved Equivalent.

2.02 RIGID METAL CONDUIT (RMC)

- A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
 1. Fittings: NEMA FB2.10.

2.03 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
- B. Fittings: NEMA FB 1; steel, compression type.

2.04 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: UL 1, interlocked steel construction.
- B. Fittings: NEMA FB 2.20.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.
- B. Fittings: NEMA FB 2.20.

2.06 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: UL 651, NEMA TC 2; Schedule 40 PVC.
- B. Fittings: NEMA TC 3.

2.07 CONDUIT FITTINGS

- A. Bushings:
 - 1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.
 - 2. Insulated grounding type for threaded raceway connectors.
- B. Raceway Connectors and Couplings:
 - 1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
 - 2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
 - 3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
 - 4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
 - 5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.
- B. Conduit Size:
 - 1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.
- C. Underground Installations:
 - 1. More than 5-feet from Foundation Wall: Use PVC.
 - 2. Within 5-feet from Foundation Wall: Use PVC coated RMC.
 - 3. In or Under Slab on Grade: Use PVC.
 - 4. Minimum Size: 1-inch.
- D. Provide two pull strings/tapes in empty conduits. Types:
 - 1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.

2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
 3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
 4. Secure pull string/tape at each end.
 5. Provide caps on ends of empty conduit to be used in future.
 6. Label both ends of empty conduits with location of opposite end.
- E. Elbows: Use fiberglass or PVC coated RMC for underground installations.
- F. Verify that field measurements are as shown on Drawings.
- G. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.
- H. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
1. Where shown on the Structural Drawings.
 2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- I. Verify routing and termination locations of conduit prior to rough-in.
- J. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- K. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- L. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.
- M. Install nonmetallic conduit in accordance with manufacturer's instructions.
- N. Inserts, anchors and sleeves.
1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
 2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.
- O. Conduit Supports:
1. Arrange supports to prevent misalignment during wiring installation.
 2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 5. Do not attach conduit to ceiling support wires.

- P. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
- Q. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
- R. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.
- S. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
- T. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.
- U. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.
- V. Arrange conduit to maintain headroom and present neat appearance.
- W. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
- X. Exposed conduits are permitted only in following areas:
 - 1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
 - 2. Existing walls that are concrete or block construction.
 - 3. Where specifically noted on Drawings.
 - 4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
- Y. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
- Z. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
- AA. Below Grade Conduit:
 - 1. See Section 26 05 43, Electrical Vaults and Underground Raceways.
 - 2. Use PVC, PVC coated RMC, or fiberglass conduit.
 - 3. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.
- AB. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- AC. Maintain adequate clearance between conduit and piping.
- AD. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

- AE. Cut conduit square using saw or pipecutter; deburr cut ends.
- AF. Bring conduit to shoulder of fittings; fasten securely.
- AG. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.
- AH. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
- AI. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.
- AJ. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- AK. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- AL. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.
- AM. Feeders: Do not combine or change feeder runs.
- AN. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

3.02 RIGID METAL CONDUIT (RMC) INSTALLATION

- A. Outdoor Locations Above Grade: RMC.
- B. Damp Locations: RMC.
- C. In areas exposed to mechanical damage: RMC.
- D. For security conduits installed exposed and subject to tampering: RMC.

3.03 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

- A. Dry Locations:
 - 1. Concealed: EMT.
 - 2. Exposed: EMT.
- B. Dry, Protected: EMT.

3.04 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

- A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
- B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

- A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.
- B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.06 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide equipment grounding conductor in PVC conduit runs containing power conductors.
- C. Underground Installation:
 - 1. Areas subject to vehicular traffic: Schedule 80 PVC.
 - 2. Other underground applications: Schedule 40 PVC, except where prohibited by the NEC or local codes.
- D. Convert PVC conduit to Rigid Metal Conduit (RMC) prior to emerging from underground, concrete encasement, or concrete slab.
- E. PVC elbows are not acceptable. Use fiberglass or PVC coated RMC.
- F. Trim cut ends inside and outside to remove rough edges.
- G. Provide bushings when entering a box, fitting or other enclosure.

3.07 CONDUIT FITTINGS INSTALLATION

- A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.
- B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.
- D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.
- E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

- F. Use PVC coated, threaded type fittings in corrosive environments.
- G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.
- H. Condulets and Conduit Bodies:
 - 1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.
- I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
- J. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION 26 05 33

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Outlet Boxes
 - 2. Pull and Junction Boxes
 - 3. Box Extension Adapter
 - 4. Weatherproof Outlet Boxes

- B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

- B. In addition, reference the following:
 - 1. Section 26 05 33, Raceways
 - 2. Section 26 05 53, Identification for Electrical Systems

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Outlet Boxes:
 - 1. Hubbell
 - 2. Thomas & Betts
 - 3. Eaton/Crouse-Hinds
 - 4. Or approved equivalent.

- B. Pull and Junction Boxes:
 - 1. Eaton/Crouse-Hinds
 - 2. Hoffman
 - 3. Or approved equivalent.

- C. Box Extension Adapter:
 - 1. Hubbell
 - 2. Thomas & Betts
 - 3. Eaton/Crouse-Hinds
 - 4. Or approved equivalent.

- D. Weatherproof Outlet Boxes:
 - 1. Legrand (Pass & Seymour)
 - 2. Hubbell
 - 3. Thomas & Betts
 - 4. Eaton/Crouse-Hinds
 - 5. Intermatic
 - 6. Or approved equivalent.

2.02 OUTLET BOXES

- A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.

- B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Installation of one or two devices at common locations, minimum 4-inches square, minimum 2-inches deep for USB type devices. Single- or two-gang flush device raised covers.

- C. Masonry Boxes: Outlets in concrete.

- D. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.

- E. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.03 PULL AND JUNCTION BOXES

- A. Construction: Provide ANSI 61 gray polyester powder painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.
- C. Fiberglass Handholes: Die molded glass fiber hand holes:
 - 1. Cable Entrance: Pre-cut 6- x 6-inch cable entrance at center bottom of each side.
 - 2. Cover: Fiberglass weatherproof cover with nonskid finish.
 - 3. Cover Legend: ELECTRIC.

2.04 BOX EXTENSION ADAPTER

- A. Construction: Diecast aluminum.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.05 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

- B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.
- C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.
- F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10-feet if required to accommodate intended purpose.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.
- K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.
- L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.
- M. Install knockout closures in unused box openings.
- N. Clean interior of boxes to remove dust, debris, and other material.
- O. Clean exposed surfaces and restore finish.

3.02 OUTLET BOXES INSTALLATION

- A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
 - 1. Control Switches:
 - a. 48-inches to the top of outlet box.
 - 2. Receptacles: 15-inches to the bottom of outlet box.
 - 3. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.
- D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.
- E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.
- G. Use flush mounting outlet box in finished areas.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Use adjustable steel channel fasteners for hung ceiling outlet box.
- K. Use gang box where more than one device is mounted together. Do not use sectional box.
- L. Use gang box with plaster ring for single device outlets.
- M. Adjust flush-mounting outlets to make front flush with finished wall material.

3.03 PULL AND JUNCTION BOXES INSTALLATION

- A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Do not fasten boxes to ceiling support wires.
- D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.04 BOX EXTENSION ADAPTER INSTALLATION

- A. Match material to box.
- B. Install gaskets at exterior and wet locations.

3.05 WEATHERPROOF OUTLET BOXES INSTALLATION

- A. Use cast outlet box in exterior locations exposed to weather and wet locations.
- B. Install gaskets.

END OF SECTION 26 05 34

SECTION 26 05 43
ELECTRICAL VAULTS AND UNDERGROUND RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Handholes
 - 2. Raceways

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. Section 26 05 33, Raceways

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit (EPC-40 and EPC-80).
 - 2. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - 3. NEMA TC 6/8 - Extra-Strength PVC Plastic Utilities Duct for Underground Installation.
 - 4. NEMA TC 9 - Fittings for Extra-Strength Plastic Utilities Duct for Underground Installation.
 - 5. NEMA TC 14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 - 6. UL 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Shop drawings detailing items provided under this Section:
 - a. Vault cover assigned designators.
 - b. Duct entry schedule.
 - c. Pulling iron working load.

- d. ASTM load designation and percentage increase in live load for impact.
- e. Vault section weights.
- f. Rebar and piling support details.
- g. Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes and handholes.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.
 - 2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Handholes:
 - 1. Oldcastle Precast
 - 2. Jensen Precast
 - 3. Hubbell/Quazite
 - 4. Or approved equivalent.
- B. Raceways:
 - 1. See Section 26 05 33, Raceways.
 - 2. Fiberglass (RTRC):
 - a. FRE Composites Corp.
 - b. Champion Fiberglass
 - c. United Fiberglass of America

2.02 HANDHOLES

- A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors.

- B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during construction.
- C. Lid: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors, with nonskid finish, neoprene gaskets and stainless steel screws. Same size as opening of housing for as much hand space as possible for wire access.
- D. Lid Legend: ELECTRICAL.
- E. Cable Entrance: Pre-cut 6 x 6-inch cable entrance at center bottom of each side.

2.03 RACEWAYS

- A. See Section 26 05 33, Raceways.
- B. PVC Conduit: NEMA TC 2; Schedule 40. Fittings and Conduit Bodies: NEMA TC 3.
- C. Plastic Utilities Duct: NEMA TC 6/8; PVC Type DB.
- D. Plastic Utility Duct Fittings: NEMA TC 9.
- E. Fiberglass Conduit (RTRC), Elbows and Fittings: NEMA TC 14 and UL 1684.
 1. Conduit and Fittings: 0.095 inches wall thickness.
 2. Large Sweep Elbows: 1.110 inches wall thickness.
 3. Joining Method: Supply each length of conduit with a tapered spigot and an integral bell with an integral urethane Tri-Seal gasket held in place with a retaining ring. Minimum 400 pound for the Tri-Seal joint.
 4. Adapters: Provide appropriate UL Listed adapters for transitions to and from PVC and steel conduit.
 5. Provide conduit in 20 foot lengths, free of burrs and ridges.
 6. Fabricate sweeps in one piece, without couplings, joints or tangent lengths, other than at ends.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's instructions and recommendations.
- B. Plan locations of duct runs in advance of the installation. Coordinate with site utility systems and building foundation depths.
- C. Duct bank routing is shown on drawings in approximate locations unless dimensions are indicated. Verify routing and termination locations of duct bank prior to excavation for rough-in. Route as required to complete duct system.

- D. Handhole locations are shown on drawings in approximate locations unless dimensions are indicated. Verify locations of handholes prior to excavating for installation. Locate as required to complete duct bank system.
- E. Cleaning Handholes: Clean and leave free of debris, silt and rocks from installation work.

3.02 HANDHOLES

- A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.
- B. Set base plumb and level. Set handhole such that cover surface matches finished grade.
- C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.
- D. Turn conduits up into handhold with required bend radius per guidance in 26 05 33, Raceways.
- E. Engrave cover of handhole to identify its purpose (examples: "Power," "Emergency Power," "Signal," "Fire Alarm").

3.03 RACEWAYS

- A. Power and System Duct Bank Raceways: PVC, Fiberglass (RTRC) or PVC coated Rigid Metal Conduit.
- B. Elbows for Power and System Raceways: Fiberglass (RTRC) elbows or PVC coated Rigid Metal Conduit elbows.
- C. Provide all excavation and backfill required to support Division 01 and this Division of work. Coordinate trench specs for concrete, soil or sand backfill.
- D. Excavate trenches six inches deeper and wider than ductbank burial and cross-sectional requirements. Remove from the site all excavated materials not suitable or specified for backfill.
- E. Backfill trenches with sand, tamped firm and even to trench depth level.
- F. Backfill with non-expansive soil with limited porosity. Deposit all backfill soil in 6-inch layers. Thoroughly and carefully tamp all backfill soils to 90-95 percent compaction until the ductbank is covered by no less than 12 inches of material. Backfill and tamp the remainder of the excavation at 12-inch intervals. Uniformly grade the finished surface.
- G. Provide sheeting, shoring, dewatering and cleaning required to keep the trenches and their grades in proper condition for the work to be carried on.
- H. Restore all landscape and paving to like new to match existing.
- I. Slope raceways away from buildings and drain towards manholes or vaults with a minimum slope of 3 percent. Drain raceways into manholes or vaults, not into building structures or panels. Where sloping cannot be fully provided and there is a section of raceway where water

would flow to a panel, switchboard, transformer, or building, provide a means to discharge the excess water from the raceway, or raceway system, consisting of a box or fitting at a low point prior to equipment entry, or at building entry, with a fitting or plug that can be removed to allow drainage.

- J. Cut raceway square using saw or pipe cutter; de-burr cut ends.
- K. Insert raceway to shoulder of fittings; fasten securely.
- L. Join PVC raceway using adhesive as recommended by manufacturer.
- M. Wipe PVC raceway dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- N. Number of equivalent 90-degree bends permitted between pull points: Maximum of three bends for power system conduit banks.
- O. Provide suitable fittings to accommodate expansion and deflection where required.
- P. Terminate raceway at manhole entries using end bells.
- Q. Use suitable separators and chairs installed not greater than 5 feet on centers.
- R. Provide 1/4-inch polypropylene pull rope in each empty raceway except sleeves and nipples.
- S. Swab raceway. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- T. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

END OF SECTION 26 05 43

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Equipment Nameplates
 2. Device Labels
 3. Wire Markers
 4. Underground Warning Tape

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements
- B. Submittals not required for this Section.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
 3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Equipment Nameplates:
 - 1. B & I Nameplates
 - 2. Intellicum
 - 3. JBR Associates
 - 4. Or approved equivalent.
- B. Device Labels:
 - 1. Kroy
 - 2. Brady
 - 3. Or approved equivalent.
- C. Wire Markers:
 - 1. Brady
 - 2. Panduit
 - 3. Sumitomo
 - 4. Or approved equivalent.
- D. Underground Warning Tape:
 - 1. Allen Systems
 - 2. Brady
 - 3. Or approved equivalent.

2.02 EQUIPMENT NAMEPLATES

- A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.
- B. Color:
 - 1. Normal (Utility): White letters on black background.
- C. Letter Size:
 - 1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.

2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.
 3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.
- D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.
- F. Locations:
1. Branch panels.
 2. Main breakers and distribution breakers in distribution panels.
 3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
 4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.
 5. Distribution transformers.

2.03 DEVICE LABELS

- A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.
- B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.04 WIRE MARKERS

- A. Description: Vinyl-cloth self-adhesive type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.
- C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.
- D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.05 UNDERGROUND WARNING TAPE

- A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate designations used on Drawings with equipment nameplates and device labels.
- B. Install nameplates and labels parallel to equipment lines.
- C. Identify empty conduit and boxes with intended use.
- D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

3.02 EQUIPMENT NAMEPLATES

- A. Degrease and clean surfaces to receive nameplates.
- B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.
- C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.
- E. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.
 - 1. See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project.

3.03 DEVICE LABELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Degrease and clean surfaces to receive labels.

3.04 WIRE MARKERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Provide wire markers on each conductor for power, control, signalling and communications circuits.
- D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

3.05 UNDERGROUND WARNING TAPE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finish grade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

END OF SECTION 26 05 53

SECTION 26 05 73
ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Protective Devices
 - 2. Short Circuit Study
 - 3. Protective Device Study
 - 4. Arc Flash Labels
 - 5. Arc Flash Risk Assessment

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - 2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
 - 3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition provide:
 - 1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.
 - 2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.
 - a. Provide written verification with Stamp or Seal and signature of preparing Engineer.

3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.
 - a. Experienced in preparation of studies of similar type and magnitude.
 - b. Familiar with software analysis products specified.
 2. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.
 - a. Acceptable Software Products:
 - 1) EasyPower
 - 2) Operation Technology, Inc; ETAP.
 - 3) SKM Systems Analysis, Inc; Power Tools for Windows.
 3. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
 1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
 2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
 4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
 1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.
 2. Breaker and fuse ratings.
 3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 4. Identification of each bus, with voltage.
 5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

2.02 PROTECTIVE DEVICES

- A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.
- B. Replace existing protective devices to achieve specified performance.
- C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
 1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.
 3. Identify any equipment that is underrated as specified.
 4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
 5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
 6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
 7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.
- D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
 1. Device identification.
 2. Relay CT ratios, tap, time dial, and instantaneous pickup.

3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
 4. Fuse rating and type.
 5. Ground fault pickup and time delay.
 6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
 7. Highlight devices that as furnished by Contractor will not achieve required protection.
- E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.
- F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.

2.03 SHORT CIRCUIT STUDY

- A. Calculate fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
1. Show fault currents available at key points in system down to fault current of 1,000 A at 480 V and 208 V.
 2. Include motor contributions in determining momentary and interrupting ratings of protective devices.
 3. Primary Fault Level Assumptions: Obtain data from utility company.

2.04 PROTECTIVE DEVICE STUDY

- A. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.
 3. Identify any equipment that is underrated as specified.
 4. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
 5. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
 6. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.

7. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
 8. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Architect.
- B. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
1. Device identification.
 2. Relay CT ratios, tap, time dial, and instantaneous pickup.
 3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
 4. Fuse rating and type.
 5. Ground fault pickup and time delay.
 6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
 7. Highlight devices that as furnished by Contractor will not achieve required protection.

2.05 ARC FLASH LABELS

- A. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

2.06 ARC FLASH RISK ASSESSMENT

- A. Calculate arc flash incident energy (AFIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at each bus and piece of equipment during normal conditions, emergency power conditions, and other operations that could result in maximum arc flash incident energy levels.
 1. Show flash protection boundary distance.
 2. Include incident energy levels.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Provide services of qualified field engineer and necessary tools and equipment to test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.
- B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.
- C. Submit report showing final adjusted settings of protective devices.

3.02 ELECTRICAL POWER SYSTEM STUDIES

A. Short Circuit Analysis Study:

1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including contributions from normal source of power without alternative sources of power. Include complete low voltage distribution systems as specified in this Section.
2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.
3. Perform study in accordance with applicable ANSI/IEEE Standards.
4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generator contributions; applicable circuit parameters and contribute to short circuit duty.
5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).
6. Perform equipment evaluation study to determine adequacy of overcurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Owner in writing where problem areas or inadequacies appear in electrical equipment.
7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utility and generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Protective Device Study:

1. Perform time-current coordination analysis with aid of computer software intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.
2. Where necessary, make an appropriate compromise between system protection and service continuity with service continuity considered more important than system protection.
3. Provide sufficient number of computer generated log-log plots to indicate degree of system protection and coordination by displaying time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. Computer printouts accompany log-log plots and will contain descriptions for each of devices shown, settings of adjustable devices, short-circuit current availability at device location when known, and device identification numbers to aid in locating devices on log-log plots and system one-line diagram.
5. Study includes separate, tabular computer printout containing suggested device settings of adjustable overcurrent protective devices, equipment where device is located, and device number corresponding to device on system one-line diagram.

6. Provide computer generated system one-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and maximum available short-circuit current at each bus when known.
7. Discussion Section which evaluates degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
8. Call significant deficiencies in protection and/or coordination to attention of Engineer and recommendations made for improvements as soon as they are identified.
9. Contractor responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in timely manner to allow time-current analysis to be completed prior to final installation.

C. Arc Flash Risk Assessment:

1. Perform arc flash risk assessment with aid of computer software intended for this purpose.
2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.
3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.
6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.
7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
8. Proposed vendor demonstrates experience in providing equipment labels in compliance with CEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION 26 05 73

SECTION 26 08 10
BUILDING LIGHTING ACCEPTANCE TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Duties of the Team
 - 2. Time Schedule
 - 3. Acceptance Testing - Phase I - Documentation
 - 4. Acceptance Testing - Phase II - Inspection and Testing
 - 5. Acceptance Testing - Phase III - Certification
- B. This Section describes the acceptance testing and documentation of the lighting system(s) and outlines the duties and responsibilities of the contracting team for acceptance testing.
- C. Supply the acceptance requirements to products, equipment and systems provided under this Division, where indicated on Drawings, and where required by California Title 24 requirements.
- D. Engage the services of a firm specializing in commissioning of lighting systems or submit contractor qualifications for review by architect where testing and documentation is to be performed by contractor.

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 COMMISSIONING TEAM

- A. Form the Commissioning Team of:
 - 1. Electrical Contractor's Representative
 - 2. Lighting Controls Manufacturer's Representative
 - 3. Inspector of Record
 - 4. Owner's Staff Representative

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 DUTIES OF THE TEAM

- A. The duties of the Team are as outlined in the California Title 24 requirements and summarized below:
 - 1. Plan, organize and implement the acceptance testing process and within 1 month of the award of the contract, submit the names and addresses of the Testing team member(s).
 - 2. The acceptance testing team to submit a complete description of the testing procedures and systems to be tested to the architect for review.
 - 3. The acceptance testing team to coordinate tests of systems and equipment and assemble documentation related to tests. Submit documentation relative to tests and proposed procedures to design engineer for review prior to submitting documentation to Authority Having Jurisdiction (AHJ). Team responsible for performing data analysis, calculation of performance indices and cross-checking of results with the requirements of California Title 24 and the Contract documents. The installing contractor or agent responsible for testing and documentation to record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.
 - 4. Responsible for submitting Certificate of Acceptance including paper and electronic copies of measurements and monitoring results and supporting documentation to the AHJ. Where AHJ questions results or requires additional testing, complete additional testing and provide required documentation at no additional cost to the Owner.

3.02 TIME SCHEDULE

- A. Determine the time period of the commissioning of the systems by the general contractor and acceptance testing team. It is important to note that AHJ will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the California Title 24 standards.

3.03 ACCEPTANCE TESTING - PHASE I - DOCUMENTATION

- A. Team to assemble documentation showing lighting fixture locations, lighting control device locations, control sequences and notes.
- B. Per California Title 24 requirements, team to provide record drawings to building Owner within 90 days of receiving a final occupancy permit (reference other specification Sections for requirements on record drawings.)
- C. Per California Title 24 requirements, team to provide operating and maintenance manuals to the building Owner (reference other specification Sections for requirements on operation and maintenance manuals.)

3.04 ACCEPTANCE TESTING - PHASE II - INSPECTION AND TESTING

- A. Team to review the installation, perform acceptance testing and document results for the following systems:
 - 1. Automatic Time Switch Controls
- B. Review of installation to confirm lighting fixtures and lighting controls are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

3.05 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

- A. Team to document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the AHJ prior to receiving final occupancy permit.
- B. Team to submit NRCA-LTI and NRCA-LTO forms as required by California Title 24 requirements.

3.06 ACCEPTANCE TESTS AND DOCUMENTATION

- A. Reference State of California requirements for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with standards as required by Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements as well as State and governmental standards related to this work.
- B. Reference California Title 24, 2019 Nonresidential Compliance Manual and Documents for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with these standards. The detailed requirements can be found at: <http://www.energy.ca.gov/title24/2019standards/index.html>.

END OF SECTION 26 08 10

SECTION 26 09 43
NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components:
 - 1. Wired Networked Devices
 - a. Wall Stations
 - b. Graphic Wall Stations
 - c. Power Packs and Secondary Packs
 - d. Networked Luminaires
 - e. Relay and Dimming Panel
- B. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.02 RELATED DOCUMENTS

- A. Section 26 27 26 Wiring Devices
- B. Section 26 51 00 Lighting

1.03 SUBMITTALS

- A. Submittal shall be provided including the following items:
 - 1. Bill of Materials necessary to install the networked lighting control system.
 - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - 3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
 - 4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
 - 5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
 - 6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
 - 7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
 - 8. Hardware and Software Operation Manuals.

1.04 APPROVALS

- A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
- B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.
- D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.05 QUALITY ASSURANCE

- A. Product Qualifications
 - 1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
 - 2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
 - 3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
 - 4. All components shall be subjected to 100 percent end of line testing prior to shipment to the project site to ensure proper device operation.
 - 5. All components and the manufacturing facility where product is manufactured must be RoHS compliant.
- B. Installation and Startup Qualifications
 - 1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- C. Service and Support Requirements
 - 1. Phone Support: Toll free technical support shall be available.
 - 2. Remote Support: The bidder shall offer a remote support capability.
 - 3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
 - 4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.06 PROJECT CONDITIONS

- A. Only install indoor equipment after the following site conditions are maintained:

1. Ambient Temperature: 14 to 105 degrees F (minus 10 to 40 degrees C)
 2. Relative Humidity: less than 90 percent non-condensing
- B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.
- C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.07 WARRANTY

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.08 MAINTENANCE & SUSTAINABILITY

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
1. Acuity Brands Lighting, Inc.
- B. Basis of Design System: Acuity Controls Fresco with nLight Components

2.02 SYSTEM COMPLIANCE

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. System components shall comply with ISED Canada RSS-247 standards where applicable.
- D. All equipment shall be installed and connected in compliance with NFPA 70.

2.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections).
4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”
6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
2. Devices shall be connected via a “daisy-chain” topology.
3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming

mechanism (e.g. software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. Low-Voltage power sensing: These devices shall automatically provide 100 percent light level upon detection of loss of power sensed via the low voltage network cable connection.
 - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
8. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.
9. Wired networked Wall stations shall provide the follow Scene Control Capabilities:
 - a. Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
 - b. Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

C. System Integration Capabilities

1. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)

D. Supported Sequence of Operations

1. Control Zones

- a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.
2. Wall station Capabilities
- a. Wall stations shall be provided to support the following capabilities:
 - 1) On/Off of a local control zone.
 - 2) Continuous dimming control of light level of a local control zone.
3. Global Profile Capabilities
- a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
 - b. Global profiles may be scheduled with the following capabilities:
 - 1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
 - 3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
 - 4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
 - 5) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
 - c. System Global Profiles shall have the following additional capabilities:
 - 1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.
 - 2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
 - 3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response),

response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

- d. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.

E. Astronomical Time Clock

1. Shall be capable of up to 36 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.
2. Shall be run from non-volatile memory so that all system programming is retained indefinitely.
3. 10 year battery backup.
4. Product Series: Fresco 7TSN "Touchscreen" controller.

2.04 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Product Series: nPODM, nPODM xS, nPODM xL, nPODMA, nPODMA xS, nPODMA xL.
2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
6. Devices with mechanical push-buttons shall be made available with custom button labeling.
7. Wall switches & dimmers shall support the following device options:
 - a. Number of control zones: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
 - c. Colors: Ivory, White, Light Almond, Gray, Black, Red
8. Scene controllers shall support the following device options:
 - a. Number of scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) Preset Level Scene Type
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature

- 5) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
9. Colors: Ivory, White, Light Almond, Gray, Black, Red

B. Wired Networked Power Packs and Secondary Packs

1. Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS-60, nPS-80
2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
3. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
5. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
7. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
11. Power/Secondary Packs shall be available with the following options:
 - a. Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - b. Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - c. Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.

- d. Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
- e. Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
- f. Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
- g. Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
- h. Secondary Pack capable of louver/damper motor control for skylights.
- i. Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
- j. Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
- k. Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

C. Wired Networked Luminaires

- 1. Product Series: Networked Luminaires shall be of the following Acuity Brands LED fixtures, which come factory enabled with embedded networking capability:
 - a. Lithonia model families:
 - 1) BLT(R/X)
 - 2) RTL(R/X)
 - 3) VTL(R/X)
 - 4) TL(X)
 - 5) FSL(X)
 - 6) ACL(X)
 - 7) ALL(S)
 - 8) AVL
 - 9) BZL
 - 10) GTL
 - 11) SBS
 - 12) IBL/IBH
 - 13) PTN
 - 14) LDN
 - 15) DOM
 - 16) WL
 - 17) STL
 - b. Gotham model families:
 - 1) EVO
 - 2) Incito
 - c. Mark model families:
 - 1) Slot 2/4/6

- 2) Fin
 - 3) Veil
 - 4) Whisper
 - 5) Nol
 - 6) SPR
 - 7) RUBIK
- d. Peerless model families:
- 1) Vellum
 - 2) Mino
 - 3) Round 2/4
 - 4) Square
 - 5) Origami
 - 6) Bruno
 - 7) Staple
 - 8) Lightline
 - 9) Lightedge
 - 10) Icetray
 - 11) Cerra
 - 12) Prima
 - 13) Naro
 - 14) Tulip
 - 15) Envision
 - 16) Aero
 - 17) Enzo
2. Networked luminaire shall have a mechanically integrated control device.
 3. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter).
 4. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers).
 5. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG and CCT capable versions).
 6. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode.”
 7. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
 - a. System shall indicate (via a blink warning) when the LED luminaire is no longer able to compensate for lumen depreciation.
 8. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
 9. System shall be able to provide control of network luminaire intensity, in addition to dynamic features, such as grayscale and color accent of specific LED luminaires.

- D. Wired Networked Relay and Dimming Panel
1. Product Series: Fresco LMP
 2. Relay and dimming panel shall be available with 3, 6, or 9 individual relays per panel, with an equal number of individual 0-10V, phase-dimming or DALI dimming outputs.
 3. Product Series: nLight ARP
 4. Relay and dimming panel shall be available with 4, 8, 12, 16, 24, 32, 40 or 48 individual relays per panel, with an equal number of individual 0-10V dimming outputs.
 5. Optional Field Configurable Relays (FCR) used shall have the following required properties:
 - a. Configurable in the field to operate with single-, double-, or triple-pole relay groupings.
 - b. Configurable in the field to operate with normally closed or normally open behavior.
 - c. Provides visual status of current state and manual override control of each relay.
 - d. Listed for the following minimum ratings:
 - 1) 40A @ 120-480VAC Ballast
 - 2) 16A @ 120-277VAC Electronic
 - 3) 20A @ 120-277VAC Tungsten
 - 4) 20A @ 48VDC Resistive
 - 5) 2HP @ 120VAC
 - 6) 3HP @ 240-277VAC
 - 7) 65kA SCCR @ 480VAC
 6. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
 7. Relay and dimming outputs shall be individually programmable to support all standard sequence of operations as defined in this specification.
 8. Panel shall be UL924 listed for control of emergency lighting circuits.
 9. Panel shall power itself from an integrated 120-277 VAC or optional 347VAC supply.
 10. Panel shall provide a configurable low-voltage sensor input with the following properties:
 - a. Configurable to support any of the following input types:
 - 1) Occupancy Sensor
 - 2) Contact Closure
 - b. Low voltage sensor input shall provide plus 24VDC power for the sensor so that additional auxiliary power supplies are not required.
 - c. Sensor input supports all standard sequence of operations as defined in this specification.
 11. Panel shall provide a contact closure input for each group of 8-relays that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel. This input is intended to provide an interface to alarm systems, fire panels, or BMS system to override the panel.
 12. Panel shall supply current limited low voltage power to other networked devices connected via low voltage network cable.
 13. Panel shall be available with NEMA 3R exterior rated enclosure with the following mounting and cover options:

- a. Surface-mounted for all panel sizes
 - b. Flush-mounted for up to 16 relay panel sizes
 - c. Screw-fastened for up to 16 relay panel sizes
 - d. Hinged cover with keyed lock for all panel sizes
14. Surface-mounted screw cover options for 8 and 16 relay panel sizes shall be plenum rated
15. Panel shall be rated from 0-50C for 8 and 16 enclosure sizes, and 0-45C for 32 and 48 enclosure sizes.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Installation Procedures and Verification

- 1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
- 2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
- 3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - b. Length
 - c. Insertion Loss

B. Coordination with Owner's IT Network Infrastructure

- 1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
 - b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Documentation and Deliverables

- 1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
- 2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 - a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing drawing files for electronic submission.

- b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
 - (a) Titleblock
 - (b) Text- Inclusive of room names and numbers, fixture tags and drawings notes
 - (c) Fixture wiring and homeruns
 - (d) Control devices
 - (e) Hatching or poché of light fixtures or architectural elements
 - 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.02 SYSTEM STARTUP

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
 - 1. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.
- B. System start-up and programming shall include:
 - 1. Verifying operational communication to all system devices.
 - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 - 3. Programming and verifying all sequence of operations.
 - a. Initial start-up and programming is to occur on-site.

3.03 PROJECT TURNOVER

- A. System Documentation
 - 1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
 - 2. Installing contractor to grant access to the owner for the programming database, if requested.
- B. Owner Training
 - 1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION 26 09 43

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Two-Winding Transformers

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. UL 1561: Dry-Type General Purpose and Power Transformers.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Production test each unit according to NEMA Standard 20.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric/Square D
- B. Eaton
- C. ABB/General Electric
- D. Siemens
- E. Or approved equivalent.
- F. Basis of Design: Schneider Electric/Square D. Manufacturers listed are allowed on condition of meeting specified conditions including available space for equipment and Code required working clearances. Remove and replace equipment installed that does not meet these conditions at no cost to Owner.

2.02 TWO-WINDING TRANSFORMERS

- A. Description: Factory assembled, air cooled dry type transformer. Efficiency compliant with Federal Code 10 CFR Part 431 and DOE 2016 efficiency requirements. NEMA TP-1 efficiency levels are not acceptable.
- B. Primary Voltage: 480 volts, 3 phase.
- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Windings: Aluminum.
- E. Insulation system and average winding temperature rise for rated kVA as follows:
 - 1. 1-15 kVA: Class 220 with 115 degrees C rise.
 - 2. 16-500 kVA: Class 220 with 115 degrees C rise.
- F. Maximum Winding Temperature: Do not exceed 30 degrees C rise above 40 degrees C ambient at warmest point at full load.
- G. Winding Taps:
 - 1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
 - 2. Transformers 15 kVA and Larger: NEMA ST 20.
- H. Conductor Termination Lugs: Compression.
- I. Sound Levels: NEMA ST 20.
- J. Basic Impulse Level: 10 kV.

- K. Impedance: 3 to 5 percent, unless otherwise noted on drawings. Minimum reactance 2 percent.
- L. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- M. Mounting:
 - 1. 1-15 kVA: Suitable for wall or trapeze mounting.
 - 2. 16-75 kVA: Suitable for wall or trapeze mounting.
- N. Coil Conductors: Continuous windings with terminations brazed or welded.
- O. Transformer Enclosure: NEMA ST 20.
 - 1. Interior: Type 1.
 - 2. Ventilated.
 - 3. Provide lifting eyes or brackets.
- P. Isolate core and coil from enclosure using vibration-absorbing mounting pads.
- Q. Nameplate: Reference Section 26 05 53, Identification for Electrical Systems.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set transformers plumb and level.
- B. Use flexible conduit, 2-foot minimum length with slack, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer. Mount to allow a minimum of 6-feet, 6-inches headroom below unit.
- D. Mount trapeze-mounted transformers as indicated.
- E. Provide grounding and bonding in accordance with Section 26 05 26, Grounding and Bonding of Electrical Systems.
- F. Clearance: Minimum 6-inches clear on sides and back. Front clearance per NEC 110.26. Maintain minimum clearance from combustible materials per NEC. Comply with manufacturers recommendations.
- G. Unacceptable Humming and Noise Levels: Revise installation as required to achieve a noise level less than or equal to those defined in NEMA ST-20 for associated transformer size or replace with a new unit with an acceptable sound level.
- H. Provide equipment nameplates per Section 26 05 53, Identification for Electrical Systems.

- I. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting.
- B. Perform inspections and tests listed in accordance with manufacturers requirements. In addition including following:
 - 1. Perform turns ratio tests at tap positions.
 - 2. Verification that as-left tap connections are as specified.
 - 3. Perform excitation-current tests on each phase.
 - 4. Measure resistance of each winding at each tap connection.
 - 5. Overpotential test on high- and low-voltage windings-to-ground.
- C. Check for damage and tight connections prior to energizing transformers.

END OF SECTION 26 22 00

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Panelboards

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 73, Electrical Distribution System Studies.
 - 2. Section 26 28 00, Overcurrent Protective Devices.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. UL 67, Standards for Panelboards.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Panelboards:
 - 1. Eaton
 - 2. ABB/General Electric
 - 3. Siemens
 - 4. Basis of Design: Schneider Electric/Square D
 - 5. Or approved equivalent.

- B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, and amps interrupting capacity (AIC) per short circuit study in Section 26 05 73, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.02 PANELBOARDS

- A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 or as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5-3/4-inches for flush mounted.

- B. Maximum Width: 20-inches.

- C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.

- D. Panelboard Bus Non-Reduced: Aluminum, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.

- E. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.

- F. Provide double lugs and/or feed-through lugs for feed through feeders.

- G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.

4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
 5. Do not use tandem circuit breakers.
- H. Accessories: Provide where indicated: shunt trip, Class A ground fault circuit interrupter (GFCI), auxiliary switch, and alarm switch.
 - I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.
 - J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.
 - K. Furnish surface mounted cabinet boxes without knockouts.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.
- B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.
- F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.
- G. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- H. Provide concrete housekeeping pad for floor-mounted distribution panelboards. Extend 6-inches beyond distribution panel width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
- I. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.

- J. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.
- K. Ground and bond panelboard enclosure per NEC.
- L. Paint:
 - 1. Standard factory finish unless noted otherwise.
 - 2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.
- M. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.
- N. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.
- O. Verify available recessing depth and coordinate wall framing with other divisions.
- P. Maintain fire rating of wall where panels are installed flush in fire rated walls.
- Q. Perform inspections and tests in accordance with manufacturer's requirements.
- R. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.
- S. Vacuum construction dust, dirt, and debris out of each panelboard.
- T. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.02 PANELBOARDS INSTALLATION

- A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.
- B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

- D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provision of materials, installation and testing of:
 - 1. Wall Switches
 - 2. Receptacles
 - 3. Finish Plates
 - 4. Surface Covers

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Wall switches
 - 2. Receptacles
 - 3. Wall Plates
 - 4. In-Use Cover

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Wall Switches:
 - 1. Toggle Type Characteristics:
 - a. Cooper AH1201
 - b. Hubbell HBL1221
 - c. Leviton 1221
 - d. Legrand P&S PS20AC1
 - e. Or approved equivalent.

- B. Receptacles:
 - 1. Industrial Grade:
 - a. Cooper 5362
 - b. Hubbell HBL5362
 - c. Bryant BRY5362
 - d. Leviton 5362
 - e. Legrand P&S 5362A
 - f. Or approved equivalent.
 - 2. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:
 - a. Cooper WRSGF20W
 - b. Hubbell GFR5362SGW
 - c. Legrand P&S 2097TRWR
 - d. Or approved equivalent.

- C. Finish Plates:
 - 1. Bryant
 - 2. Cooper
 - 3. Hubbell
 - 4. Leviton
 - 5. Legrand P&S
 - 6. Or approved equivalent.

- D. Surface Covers:
 - 1. Aluminum with Gasket, Blanks, Single Gang:
 - a. Bell 240-ALF
 - b. Carlon
 - c. Or approved equivalent.
 - 2. 2-Gang:
 - a. Bell 236-ALF
 - b. Carlon
 - c. Or approved equivalent.

3. While-in-Use Weatherproof Cover:
 - a. Die Cast Cover:
 - 1) Intermatic
 - 2) Hubbell
 - 3) Cooper
 - 4) Or approved equivalent.
- E. Provide lighting switches and receptacles of common manufacturer and appearance.

2.02 WALL SWITCHES

- A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.
- B. Finish: White.

2.03 RECEPTACLES

- A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.
- B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.
- C. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.
- D. Finish:
 1. Same exposed finish as switches.

2.04 FINISH PLATES

- A. Finish Plates: Type 302 stainless steel with smooth satin finish.
- B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.05 SURFACE COVERS

- A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.
- B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.
- C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
 1. Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.
- B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.
- C. Orientation:
 - 1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
 - 2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.
 - 3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.
- D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.
- E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.02 WALL SWITCHES INSTALLATION

- A. At time of substantial completion, replace those items which have been damaged.

3.03 RECEPTACLES INSTALLATION

- A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
- B. In the following outlet locations, regardless of whether shown as GFCI on Drawings, either provide a GFCI duplex receptacle, or use a GFCI breaker where code would require a GFCI outlet to have a remote test switch:
 - 1. Where receptacles are installed within 6-feet, 0-inches from edge of sinks.
 - 2. Outdoors.
- C. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

3.04 FINISH PLATES INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.05 SURFACE COVERS INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION 26 27 26

SECTION 26 28 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Molded Case Circuit Breakers

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
 - 2. Product data and time/current trip curves for circuit breakers supplied to project.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Molded Case Circuit Breakers:
 - 1. Eaton Electrical
 - 2. ABB/General Electric
 - 3. Siemens
 - 4. Schneider Electric/Square D
 - 5. Or approved equivalent.

2.02 MOLDED CASE CIRCUIT BREAKERS

- A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40 degrees C ambient temperature.
- D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
 - 2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.
- B. Install all items in accordance with manufacturers written instructions.

3.02 MOLDED CASE CIRCUIT BREAKERS

- A. Provide testing of ground fault interrupting breakers.
- B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
- C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
- D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

END OF SECTION 26 28 00

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Toggle Type Disconnect Switches
 - 2. Safety Switches

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 73, Electrical Distribution System Studies.
 - 2. Section 26 24 16, Panelboards.
 - 3. Section 26 28 00, Overcurrent Protective Devices.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Toggle Type Disconnect Switches:
 - 1. Cooper
 - 2. Hubbell
 - 3. Leviton
 - 4. Legrand (Pass & Seymour)
 - 5. Slater
 - 6. Or approved equivalent.

- B. Safety Switches:
 - 1. Eaton Electrical
 - 2. ABB/General Electric
 - 3. Siemens
 - 4. Schneider Electric/Square D
 - 5. Or approved equivalent.

2.02 TOGGLE TYPE DISCONNECT SWITCHES

- A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.

- B. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.

- C. Handle lockable in 'off' position.

2.03 SAFETY SWITCHES

- A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

- B. Clearly marked for maximum voltage, current, and horsepower.

- C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

- D. Switches rated for maximum available fault current.

- E. Handle lockable in 'off' position.

- F. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.

- G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
- B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating
- C. Install in accordance with manufacturer's instructions.
- D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.02 TOGGLE TYPE DISCONNECT SWITCHES

- A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.
- B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- C. See General Installation Requirements above.

3.03 SAFETY SWITCHES

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- B. See General Installation Requirements above.

END OF SECTION 26 28 16

SECTION 26 51 00
LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Luminaires
 - 2. LED Drivers
 - 3. Lamps
- B. Provide wiring for complete and operating lighting system.

1.02 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NECA 500 - Commercial Lighting.
 - 2. UL 8750 - Light Emitting Diode (LED) equipment for use in lighting products.

1.04 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Submit product data for:
 - a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.
 - b. LED Drivers
 - c. Lamps
 - 2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.

3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.
4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:
 - a. Luminaires
 - b. LED Drivers
 - c. Lamps

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Provide luminaires acceptable to code authority for application and location installed.
 2. Comply with applicable ANSI standards.
 3. Comply with applicable NEMA standards.
 4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).
 5. Comply with CEC as applicable to installation and construction of luminaires.
 6. Comply with fallout and retention requirements of CBC for diffusers, baffles, and louvers.
 7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.06 WARRANTY

- A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Luminaires:
 1. Reference description and manufacturers in Luminaire Schedule on Drawings.

2. Or approved equivalent.
- B. LED Drivers:
1. Indoor Drivers:
 - a. eldoLED Series
 - b. Advance/Philips
 - c. Osram Sylvania
 - d. Or approved equivalent.
 2. Outdoor Drivers:
 - a. Advance/Philips
 - b. Osram Sylvania
 - c. LG
 - d. Or approved equivalent.
- C. Lamps:
1. LED (Light Emitting Diode) Lamps:
 - a. Nichia
 - b. Cree
 - c. Osram Sylvania
 - d. GE Lumination
 - e. Or approved equivalent.
 2. Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.
 3. Special types as indicated in Luminaire Schedule.
 4. Or approved equivalent.

2.02 LUMINAIRES

- A. Luminaires: Reference description and manufacturers in Luminaire Schedule on Drawings.
- B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.
- D. Finishes:
 1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.
 2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.
 3. Exterior Finishes: As detailed in Luminaire Schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

- E. Light Transmitting Components:
 1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
 2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.

- F. LED Luminaires:
 1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.
 2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.
 3. Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.
 4. LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.
 5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.
 6. Provide luminaires with integral LED thermal management system (heat sinking).
 7. Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.
 8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.03 LED DRIVERS

- A. General:
 1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
 2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
 3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.
 4. Limit inrush current to minimize breaker tripping.
 - a. Base specification: NEMA 410 standard for inrush current for electronic drivers.
 - b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.

5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
7. Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.
8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - a. Adjustment of forward LED voltage, supporting 3V through 55V.
 - b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.
 - c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
9. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.
 - a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.
4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:
 - a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.
 - b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
 - c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

- C. Control Input:
 - 1. Provide control protocol to match lighting control system specified for use with luminaire.
 - 2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
 - a. Meet IEC 60929 Annex E for General White Lighting LED drivers.
 - b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
 - c. Meet ESTA E1.3 for RGBW LED drivers.

2.04 LAMPS

- A. Provide lamps for luminaires.
- B. Provide lamp catalogued for specified luminaire type.
- C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.
- D. LED (Light Emitting Diode):
 - 1. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.
 - a. Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.
 - b. Luminaire testing per IESNA LM-79 and LM-80 procedures.
 - c. Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.
 - d. Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.
 - e. LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.
 - f. Dimming: LED system capable of full and continuous dimming.
 - g. Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.
 - 1) Nominal CCT:
 - (a) 2700 K (2725 ± 145)
 - (b) 3000 K (3045 ± 175)
 - (c) 3500 K (3465 ± 245)
 - (d) 4000 K (3985 ± 275)
 - h. Color Rendering Index (CRI) to be greater than or equal to 80.
 - 2. Special types as indicated in Luminaire Schedule.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written installation instructions and requirements.
- B. Install luminaires securely, in neat and workmanlike manner.
- C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.
- D. Wiring:
 - 1. Recessed luminaires to be installed using flexible metallic conduit or MC Cable as allowed by Section 26 05 19 with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.
 - 2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
 - 3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.
 - 4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.
- E. Relamp luminaires which have failed lamps at substantial completion.
- F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.
- G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.
- I. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- J. Install accessories furnished with each luminaire.
- K. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- L. Bond products and metal accessories to branch circuit equipment grounding conductor.
- M. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- N. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.

- O. Coordination:
1. Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.
 2. Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.
 3. Provide lighting indicated on Drawings with luminaire of the type designated and appropriate for location.
 4. Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.
 5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.
- P. Field Quality Control:
1. Perform field inspection in accordance with Division 01, General Requirements.
 2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- Q. Cleaning:
1. Clean electrical parts to remove conductive and deleterious materials.
 2. Remove dirt and debris from enclosures.
 3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.
 4. Clean photometric control surfaces as recommended by manufacturer.
 5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.
- R. Demonstrate luminaire operation for minimum of two hours.

3.02 LUMINAIRES

- A. Install per manufacturer's written installation instructions and requirements.
- B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.
- C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.
- D. Interior Luminaire Supports:
1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Maintain luminaire positions after cleaning and relamping.
 3. Support luminaires without causing ceiling or partition to deflect.

4. Provide mounting supports for recessed and pendant mounted luminaires as required by CBC.
- E. Adjusting:
1. Aim and adjust luminaires as indicated.
 2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.
 3. Align luminaires that are not straight and parallel/perpendicular to structure.
 4. Position exit sign directional arrows as indicated.

3.03 LED DRIVERS

- A. Install lamps per manufacturer's installation instructions and requirements.
- B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.
- C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION 26 51 00

SECTION 31 20 20
EARTH MOVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.02 SECTION EXCLUDES

- A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 23 33 - Trenching and Backfill.

1.03 RELATED SECTIONS

- A. Section 01 50 50 - Erosion Control
- B. Section 31 10 00 - Site Clearing

1.04 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Exploration by ENGEO Incorporated dated June 1, 2021.
- B. ASTM
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
 - 3. D2487, Classification of Soils for Engineering Purposes
 - 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction
- D. Caltrans Standard Specifications, 2018
 - 1. Section 17, General
 - 2. Section 19, Earthwork

- E. CAL/OSHA, Title 8.

1.05 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
 - 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- C. 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.
- D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.
- E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.
- F. 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.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- I. 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.
- J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.
- K. 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.
- L. Utilities: onsite underground pipes, conduits, ducts and cables.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Division 1 of the Technical Specifications.
- B. Samples:
 - 1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.
 - 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.
- C. Material Test Reports: If requested by Geotechnical Engineer, provide, from a qualified testing agency, the test results showing compliance with the project requirements.
- D. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.
 - 1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.07 QUALITY ASSURANCE

- A. Provide 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. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- C. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.
- D. 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.
- E. Perform excavation, filling, compaction and related earthwork 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 Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing.
- F. The Geotechnical Engineer will perform observations required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound

construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.

H. Finish subgrade tolerance at completion of grading:

1. Building and paved areas: ± 0.05 feet
2. Other areas: ± 0.10 feet

1.08 PROJECT CONDITIONS

- A. Promptly notify the Owner's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner's Representative 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 the Contractor has notified the Owner's Representative in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.
- D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Owner's Representative.
- E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Geotechnical Recommendations. Highly expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.
- B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 12 as determined by ASTM D4318, an expansion index less than 20, and minimum fines content of 20 percent in accordance with Section 7.4 of the Geotechnical Report, unless

otherwise specified by the Geotechnical Engineer. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

2.02 SOIL STERILANT

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wettable powder form.

PART 3 - EXECUTION

3.01 GENERAL

- A. Perform work in accordance with Caltrans Standard Specification Section 19, Earthwork, as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.
- D. Grading and earthwork operations shall be observed by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.02 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, - Dewatering, if dewatering is necessary.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

- G. Maintain dewatering system in place until dewatering is no longer required.

3.03 WET WEATHER CONDITIONS

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are 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.

3.04 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 Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative 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 related to the proposed facility shall precede a response to the submittal by the Owner'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.

3.05 TOPSOIL STRIPPING

- A. Remove topsoil in accordance with Section 31 10 00 - Site Clearing.

3.06 EXCAVATION

- A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.

- D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.07 GRADING

- A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.08 SUBGRADE PREPARATION

- A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 12 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 3 to 5 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.
- B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.
- C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.
- D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- G. Obtain the Geotechnical Engineer's approval of subgrades prior to placing pavement structural section.
- H. Blade finish lots to lines and grades indicated.

3.09 FILL PLACEMENT AND COMPACTION

- A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in uncompacted thickness in accordance with Section 7.6 of the Geotechnical Report, unless

otherwise specified by the Geotechnical Engineer. Each lift should be thoroughly moisture conditioned to at least 2% above optimum and compacted to 90 percent before successive fill layers are placed.

- B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.
- C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.
- D. Place structural fill on prepared subgrade.
- E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Do not compact by ponding, flooding or jetting.
- G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.
- H. Compaction requirements (unless specified otherwise by the Geotechnical Engineer):
 - 1. Compact structural fills less than 5 feet thick to 90 percent compaction.
 - 2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
 - 3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
 - 4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.10 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.11 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION 31 20 00

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

1.02 SECTION EXCLUDES

- A. Drainage fill material and placement around subdrains.
- B. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

1.03 RELATED SECTIONS

- A. Section 33 10 10 – Water Utilities
- B. Section 33 30 00 – Sanitary Sewerage
- C. Section 33 42 00 – Stormwater Conveyance

1.04 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Exploration by ENGEO Incorporated dated June 1, 2021.
- B. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 2. D2487, Classification of Soils for Engineering Purposes.
 - 3. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 4. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 5. E548, Guide for General Criteria Used for Evaluating Laboratory Competence.
- C. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.
- D. Caltrans Standard Specifications:
 - 1. Section 19, Earthwork.
 - 2. Section 26, Aggregate Bases.

- E. CAL/OSHA, Title 8.

1.05 DEFINITIONS

- A. AC: Asphalt Concrete.
- B. ASTM: American Society for Testing and Materials.
- C. Bedding: Material from bottom of trench to bottom of pipe.
- D. CDF: Controlled Density Fill.
- E. DIP: Ductile Iron Pipe.
- F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
- G. PCC: Portland Cement Concrete.
- H. RCP: Reinforced Concrete Pipe.
- I. 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.
- J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
- K. 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 Consultant.
 - 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Consultant. Unauthorized excavation shall be without additional compensation.
- L. Utility Structures:
 - 1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
 - 2. Sanitary sewer manholes, vaults, etc.
 - 3. Water vaults, etc.

1.06 SUBMITTALS

- A. Follow submittal procedures outlined in Division 1 of the Technical Specifications.
- B. Product Data:
 - 1. Grading and quality characteristics showing compliance with requirements for the Work.
 - 2. Certify that material meets requirements of the Project.

- C. Samples:
 - 1. If required by the Geotechnical Consultant, provide 40-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 Consultant.
 - 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Consultant and the Owner.

1.07 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Consultant.
- B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- C. 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.
- D. The Geotechnical Consultant will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Consultant, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

1.08 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner 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 Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. 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 pollution control in conformance with Division 1 of the technical specifications.

PART 2 - PRODUCTS

2.01 PIPE BEDDING AND INITIAL BACKFILL

- A. ASTM D2321, Class IA, IB or II
 - 1. Clean and free of clay, silt or organic matter.

- B. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, ¾-inch maximum.

2.02 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 23 33 – Trenching and Backfilling.
- B. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, ¾-inch maximum.

2.03 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 Consultant.
- B. Poured-in-Place Structures:
 - 1. Bedding: Bedding shall meet the approval of the Geotechnical Consultant. 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 23 33 – Trenching and Backfill.

PART 3 - EXECUTION

3.01 TRENCHING AND EXCAVATION

- A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.
- B. 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.
- C. Excavation Depth for Bedding: Minimum of 4-inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Consultant, except that bedding is not required for nominal pipe diameters of 2-inches or less.
- 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 Consultant.
 - 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 Consultant.
 - 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 Consultant.

- E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
- F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.
- G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
- H. Bottoms of trenches will be subject to testing by Geotechnical Consultant. Correct deficiencies as directed by the Geotechnical Consultant.
- I. 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.

3.02 CONTROL OF WATER AND DEWATERING

- A. 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 Consultant and the Owner until backfilling is completed.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain the Geotechnical Consultant's approval for proposed control of water and dewatering methods.
- D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- E. Maintain dewatering system in place until dewatering is no longer required.

3.03 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 Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Consultant, 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 Owner.

- 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.

3.04 PIPE BEDDING

- A. Obtain approval of bedding material from the Geotechnical Consultant.
- 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 Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of bedding material will not be permitted.
- C. Upon completion of bedding operations, and prior to the installation of pipe, notify the Geotechnical Consultant, who will inspect the bedding layer. Do not commence pipe laying until the Geotechnical Consultant has approved the bedding.

3.05 BACKFILLING

- A. Obtain approval of backfill material from Geotechnical Consultant.
- B. 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 Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of initial backfill material will not be permitted.
- C. 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 Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of subsequent backfill material will not be permitted.
- D. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.
- E. Utility backfill shall be inspected and tested by the Geotechnical Consultant during placement. Cooperate with the Geotechnical Consultant 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 Consultant and the Owner prior to proceeding with the Project.

3.06 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 Owner.

END OF SECTION 31 23 33

SECTION 32 11 00
BASE COURSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base

1.02 RELATED SECTIONS

- A. Section 31 20 00 – Earth Moving
- B. Section 32 13 13 – Concrete Paving

1.03 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Exploration by ENGEO Incorporated dated June 1, 2021.
- B. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
 - 3. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 4. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 5. E548, Guide for General Criteria Used for Evaluating Laboratory Competence.
- C. Caltrans Standard Specifications, 2018:
 - 1. Section 24, Stabilized Slopes
 - 2. Section 25, Aggregate Subbases
 - 3. Section 26, Aggregate Bases
 - 4. Section 27, Cement Treated Bases

1.04 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

1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Division 1 of the Technical Specifications.
- 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.

1.06 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 Owner. 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 36 degrees F or when the ground is frozen.
- E. Finish surface of material to be stabilized prior to lime treatment shall be as specified in Caltrans Standard Specifications Section 24.
- F. Finish surface of the stabilized material after lime treatment shall be as specified in Caltrans Standard Specifications Section 24.
- G. Finish surface of cement treated base shall be as specified in Caltrans Standard Specifications Section 27.
- 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.

1.07 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 Owner.
- C. Provide dust and noise control in conformance with Division 1 of the technical specifications.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE

- A. Material: Caltrans Standard Specification Section 26.
 - 1. Class 2, 3/4-inch Maximum: Section 26-1.02A and 26-1.02B.

PART 3 - EXECUTION

3.01 GENERAL

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.02 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.

3.03 AGGREGATE BASE

- A. Watering, Spreading and Compacting: Caltrans Standard Specifications Section 26-1.03A, 26-1.03D and 26-1.03E.

3.04 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION 32 11 0

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Removal of existing traffic stripes and pavement markers.
- B. Cleaning and sweeping of streets before application of traffic stripes and pavement markings
- C. Materials and application for traffic stripes and pavement markings.
- D. Materials and application for pavement markers.

1.02 RELATED DOCUMENTS

- A. Caltrans Standard Specifications:
 - 1. Section 84, Markings.
- B. California Building Code:
 - 1. Section 11B

1.03 SUBMITTALS

- A. Submit product data for each of the following in accordance with Division 1 of the technical specifications:
 - 1. Traffic paint

1.04 QUALITY ASSURANCE

- A. Deliver certificates showing conformance with this specification to the Owner with each shipment of materials and equipment to the Project site.

1.05 PROJECT CONDITIONS

- A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owner.
- B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.01 THERMOPLASTIC STRIPES AND MARKING

- A. Conform thermoplastic striping and marking materials to Section 84-2.02 of Caltrans Standard Specifications, unless noted otherwise herein or on the Plans.
- B. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

PART 3 - EXECUTION

3.01 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. 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.

3.02 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Section 84-2.03 of Caltrans Standard Specifications and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.03 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.

3.04 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.

3.05 ACCESSIBLE PARKING

- A. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11b-208.3.1.
- B. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
- C. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Section 11B-208.3.1.
- D. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided on a site.
- E. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4.
- F. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
 - 1. Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-502.4
 - 2. Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 5'x15' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking Spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
 - 3. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3
 - 4. Access aisles (accessible parking spaces as well - similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4
 - 5. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.5.

END OF SECTION 32 17 23

**SECTION 32 18 13
SYNTHETIC TURF**

PART 4 - GENERAL REQUIREMENTS

4.01 SCOPE OF WORK

- A. Furnish all labor, materials, tools and equipment necessary to install, in place, all synthetic turf material as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's written installation instructions, and in accordance with all approved shop drawings.
- B. Coordination with related trades to ensure a complete, integrated, and timely installation: Non expansive Fill, Aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components; as provided under its respective trade section.
- C. Prior to the beginning of installation, the Geotechnical Engineer, Turf Contractor, and Turf manufacturer of the synthetic turf shall inspect the subbase and submit a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic turf playing surface.

4.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.
- B. Section 12 93 00 – Site Furnishings & Accessories
- C. Section 31 10 00 – Site Clearing
- D. Section 31 20 00 – Earth Moving
- E. Section 31 23 00 – Excavation and Fill
- F. Section 32 18 14 –Synthetic Turf Base
- G. Division 33 --Utilities
- H. Geotechnical Report
- I. Manufacturer standard details and specifications

4.03 SUBMITTALS

- A. Shop drawings shall be prepared at the scale of the construction documents and contain all pertinent information regarding installation. These drawings shall be submitted to the Owner for approval prior to the manufacturing and shipment of materials.
- B. Prior to the beginning of installation, the Geotechnical Engineer, Turf Contractor, and Turf manufacturer of the synthetic turf shall inspect the subbase and submit a Certificate of Subbase

Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic turf playing surface.

C. Product Data:

1. Product Data including Independent Test Lab Results
2. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
3. Submit fiber manufacturer's name, type of fiber and composition of fiber.
4. Submit data in sufficient detail to indicate compliance with the contract documents.
5. Submit manufacturer's instructions and details for installation.
6. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

D. Samples:

1. Submit samples, 12 x 12 inches of turf
2. One quart sample of infill

E. Submit a copy of the 8-year (minimum), prepaid, non-prorated, third-party insured warranty and insurance policy information.

F. Warranties: Submit warranty and ensure that forms have been completed in District's name and registered with approved manufacturer.

G. Submit shop drawings for:

1. Installation details; edge detail, other inserts and covers, etc.
2. Field Layout, Striping plans; layouts showing any field lines, markings and boundaries, seams, and field logos per project drawings.
3. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.

H. Prior to Final Acceptance, the Turf Contractor shall submit to the Owner three (3) copies of Maintenance Manuals, which will include necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.

4.04 QUALITY ASSURANCE

A. Job Conditions

1. Contractor shall be responsible for reviewing the base and ensuring it conforms to the project requirements prior to placement of the synthetic turf.
2. Playing field subgrade preparation shall be completed and accepted by the Owner Representative prior to commencement of Work under this Section.

B. Manufacturer/Installer's Experience:

1. The synthetic turf installer/manufacturer shall have manufactured and installed at least fifty (50) acceptable outdoor installations of full-size football or soccer fields (minimum of 50,000 SF) in the United States within the past five (5) years with synthetic turf infilled with a system of permeable aggregate drainage and infill. Provide this listing with the bid.

2. The Turf Contractor shall employ only qualified, experienced supervisors and technicians skilled in the installation of the specified system.

C. Turf Contractor shall meet the following criteria:

1. Turf Contractor must have proper Contractors license, authority to do business in the state of California, in good standing, and have never had revocation of the same.
2. Turf Contractor must have not been disqualified or barred from performing work for any public Owner or other contracting entity in the last ten (10) years.
3. Turf Contractor must not have any fields replaced under warranty.
4. The synthetic turf contractor must provide competent workmen skilled in this specific type of synthetic turf installation. The designated Supervisory personnel on the project must be certified as competent in the installation of this material, including sewing seams and proper installation of the infill mixture. The manufacturer shall have a representative on site to certify the installation and warranty compliance.
5. Turf Contractor must be a member of American Sports Builders Association (A.S.B.A) for more than 10 years and be in good standing with the association and must have a Certified Field Builder on staff during the bidding and construction process.
6. The synthetic turf system must have been in service in the U.S. for at least eight years.
7. Turf Contractor must be a single source contractor. The contractor must install the synthetic turf and the base construction or repair with its own employees (not subcontractors) and must self-perform 100% of total scope of work.
8. The foreman installing the synthetic turf must have installed at least twenty (20) fields in the last three (3) years of the specified material.
9. Turf Contractor must be a member of the Synthetic Turf Council.
10. Turf Contractor must provide liability insurance policy with aggregate umbrella liability coverage of \$5,000,000.

4.05 WARRANTY:

- A. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; prepaid for the entire 8 year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to District's Representative notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the District. The insurance policy must be underwritten by an "AM Best" A rated carrier and must reflect the following values:
 1. Pre-Paid 8-year insured warranty.
 2. Insured Warranty Coverage must be provided in the form of 1 single policy
 3. Maximum per claim coverage amount of \$3,000,000.
 4. Maximum of five million dollar (\$5,000,000) annual aggregate

5. Must cover full 100% replacement value of total square footage installed, minimum of \$7.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface)
6. Policies that include self-insurance or self-retention clauses shall not be considered.
7. Policy cannot include any form of deductible amount.
8. Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.
9. The synthetic turf system must maintain a G-max of less than 160 for the life of the Warranty as per ASTM F355.

4.06 EXISTING CONDITIONS

- A. If the surface on which the new synthetic turf system is to be placed is a new base of porous aggregate, the Turf Contractor will be responsible for any damage to the subbase during removal/installation of the synthetic turf system *after* the deficiencies (if any) have been corrected as noted on the Certificate of Subbase Acceptability.

4.07 SCHEDULE

- A. Turf Contractor shall complete all work on the synthetic turf system in accordance with the project schedule.

4.08 SURFACE AREA

- A. The Turf Contractor is to field verify all measurements and grades.

4.09 UTILITIES

- A. Prime Contractor will supply necessary water, adequate lighting and electricity for installation.

PART 5 - PRODUCTS

5.01 MATERIALS

- A. All products including but not limited to the synthetic turf, infill, drainage tile, and shock pad shall be single sourced thru a single manufacturer per warranty requirements.
- B. All components and the installation method shall be designed and manufactured for use on outdoor athletic fields. The materials, as hereinafter specified, should be able to withstand full climatic exposure in all climates, be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow through-drainage allowing free movement of surface run-off through the turf fabric where such water may flow to the existing subbase and into the field drainage system.
- C. The finished turf surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use. The installed turf system shall be suitable for soccer, baseball, softball, physical education classes, play, and recreational use.

- D. The pile yarn (polyethylene) shall be a proven athletic caliber yarn designed specifically for outdoor use and stabilized to resist the effect of ultraviolet degradation, heat, foot traffic, water and airborne pollutants.
- E. Turf Products
 - 1. Synthetic Turf
 - a. Synaugustine 347 by Synlawn
 - b. Or approved equal
 - 2. Acceptable alternative turf products may submitted for review, provided they meet all the specified requirements in item shall include products which meet the product requirements, the experience requirements, and the warranty requirements in this specification section. Burden of proof of compliance with these requirements rests solely with the submitting turf company, not with the District, Designer, or Contractor.
- F. Perimeter and interior edge details, underground storm sewer piping and connection required for the system shall be as detailed and recommended by the manufacturer and as approved by the Owner.
- G. Carpet rolls shall be a minimum of 15' in width.
 - 1. Rolls shall be long enough to go from field sideline to sideline.
 - 2. Head seams, between the sidelines, will not be acceptable.
- H. Shock and Drainage Tile:
 - 1. Shock and drainage tile system shall have a minimum thickness height of 10mm.
 - 2. Shock and drainage tile system shall be manufactured from 100% recycled material.
 - 3. Shock and drainage tile system shall utilize interlocking tiles
 - 4. Tile System shall feature a minimum drainage capacity of 17oz. / per minute
 - 5. Tile system shall be overlain w/ a non woven geotextile fabric per the turf mfr
 - 6. Corresponding shock pad per the turf mfr
 - 7. G-Max Drain Pad, NXT-Play, Pro-play, or approved equal for all turf areas.
- I. Thread for sewing seams of turf shall be as required by the synthetic turf manufacturer.
- J. Glue for inlaying lines and markings shall be as required by the synthetic turf manufacturer.
 - 1. Nordot 34N glue manufactured by Synthetic Industries, Inc. or mfr approved equal
- K. Infill
 - 1. Infill material shall be in accordance with the manufacturer's recommendations and non-toxic per the owner's preference.
 - 2. Will be a minimum of 75% of synthetic turf pile height or as required by the turf mfr.
 - 3. Cork or approved equal.
- L. Geotextile Filter Fabric

1. Provide geotextile filter fabric in the areas designated on the Drawings. Geotextile filter fabric conform to the following minimum specifications:

Property	Test Method	Typical Values
Grab Strength	AST M D 4632	80 lb.
Puncture Strength	AST M D 4833	25 lb.
Burst Strength	AST M D 3786	130 lb.
Trapezoid Tear	AST M D 4533	25 lb.
Permeability	AST M D 4491	0.1 cm/sec
Apparent Opening Size	AST M D 4751	#50 Sieve size
Permittivity	AST M D 4491	

2. Geotextile Filter Fabric Mirafi 140 N or approved equal.

M. Impermeable Liner

1. Mirafi 600x Geotextile liner

N. Synthetic Turf Edge Connections

1. Synthetic turf edge connections made directly to concrete shall be done with Nordot 34N glue manufactured by Synthetic Industries, Inc. R
2. Synthetic turf edge connections may also be done with header boards and expanding nailing connections between the header and concrete edge band. Refer to details for additional information.

O. The installed synthetic turf hybrid turf shall have the following properties:

	Standard	Property	Specification
1	ASTM D418/D5848	Pile Weight	40 - 50 oz. /Sq. Yd.
2	ASTM D5848	Primary and Secondary Backing Weight	7.9 oz. /Sq. Yd.
3	ASTM D5848	Secondary Coating Weight	22 oz. /Sq. Yd.
4	ASTM D5848	Total Weight	69.9-79.9 oz. /Sq. Yd.
5	ASTM D1907	Yarn Denier	12,400
6	ASTM D418/D5848	Pile Height	1 ¾ - 2 ½" (+/- 1/8")
7	ASTM D5793	Tufting Gauge	1/2"
8	ASTM D5848	Primary Backing	Tri-layer woven Polypropylene
9	ASTM D5848	Secondary Coating	Polyurethane
10	ASTM D1335	Tuft Bind without Infill	10 lbs. +/-
11	ASTM D1682/D5034	Grab Tear (length)	>300 lbs. Force
12	ASTM D1682/D5034	Grab Tear (width)	>350 lbs. Force
13	ASTM D4991	Carpet Permeability	>40 inches/hour
14	ASTM D2859	Flammability (Pill Burn)	Pass
15	ASTM F355	G-max (Impact Attenuation)	<130 at installation <160 over warranty life
16	ASTM E-11	Infill	4.5 - 6 lbs +/- per square foot
17		Fabric Width	15'
18		Perforation	3/16" Holes 4" X 4"
19	ASTM D3218	Yarn	Average thickness 170 microns C8 LLDPE Resin 10,000 PPM UV Stabilizer
20	All characteristics listed above nominal +/- 5%		

PART 6 - EXECUTION

6.01 GENERAL

- A. The installation shall be performed in full compliance with the reviewed and accepted product submittal. Beginning of installation means acceptance of existing conditions.
- B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer/manufacturer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.
- C. The turf contractor shall strictly adhere to the installation procedures outlined in this section. Any variance from these requirements must be submitted to and accepted in writing, by the manufacturer's onsite representative, and submitted to the Owner, verifying that the changes do not, in any way, affect the warranty.
- D. The Project Superintendent shall thoroughly inspect all materials delivered to the site both for quality and quantity to assure that the entire installation shall have sufficient materials to maintain the schedule and proper mixing ratios.

- E. The turf manufacturer and installation team shall inspect and accept the field base, and provide documentation to that effect, prior to the installation of the synthetic grass system. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.
- F. The carpet rolls are to be installed directly over the base material and drain panel system. No equipment with loads greater than 35 pounds per square inch (35 psi) shall be allowed on the field. As required, Contractor is responsible for altering operations in order to adhere to this requirement. Contractor shall always make sure that those vehicles being used on the field bases are equipped with pneumatic (air-filled) turf tires. If possible, use of an A-frame for unrolling of the synthetic turf is strongly recommended.
- G. Verify that all sub-base leveling is complete prior to installation.
- H. Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.
 - 1. Acceptance is dependent upon the District's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
 - 2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
- I. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2" from design grade.
- J. Compaction of the subgrade and trenches shall be to 95% in accordance with Geotechnical Report.
- K. Correct conditions detrimental to timely and proper completion of Work.
- L. Do not proceed until unsatisfactory conditions are corrected.
- M. The surface to receive the synthetic turf shall be inspected, tested, and certified by the Geotechnical Engineer, Turf Contractor, and Turf manufacturer as ready for the installation of the synthetic turf system and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process. Certification shall be provided to the District in writing.

6.02 INSTALLATION

- A. The subbase and curbs shall be inspected by the Contractor by means of a laser level and plotted on a 10-foot grid. Based upon the Turf Contractor's inspection of the topological survey, the Sitework Contractor shall fine grade the subbase suitably - including properly rolling and compacting the base to achieve a surface planarity within 1/4" in 10 feet (+0, -1/4"0). OWNER, ENGINEER OR PRIME CONTRACTOR SHALL NOT APPROVE THE SUBBASE FOR TOLERANCE TO GRADE WITHOUT OBTAINING THE TOPOLOGICAL SURVEY.
- B. The carpet rolls are to be installed directly over the properly prepared base. Extreme care should be taken to avoid disturbing the base, both in regard to compaction and planarity.

- C. The full width rolls shall be laid out across the width of the field. Utilizing standard state of the art sewing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf. **GLUING OF ROLLS SHALL NOT BE ACCEPTABLE.**
- D. The synthetic turf field shall utilize sewn seams. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications. Seams between turf panels must be sewn. Inlaid markings may not be installed by means of cutting through the fabric and adhering the colored turf to a separate reinforcing tape or cloth. Rather, inlaid markings (that cannot be tufted into the fabric), shall be installed by means of shearing out the existing fiber and laying in a new piece of colored fabric into a bed of suitable "hot melt" adhesive placed directly on the original turf backing material. Systems that cut through the turf fabric for inlaid lines are not acceptable due to the fact that such a procedure shall weaken the structural integrity of the turf fabric backing. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.
- E. Connections of the perimeter synthetic turf edges shall be completed by one of the following two methods (refer to drawings for applicable details):
 - 1. Connection to the recycled plastic header boards shall be done with industrial staples (min. depth embedment is one inch (1") at maximum 2 inch (2") on center staple spacing.
- F. Infill materials shall be properly applied in numerous thin lifts using special broadcasting equipment to place the infill. The turf shall be raked and brushed properly as the mixture is applied. The infill materials can only be applied when the turf fabric is dry. Mix shall be uniform and even in thickness.
- G. The infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The infill shall be placed so that there is a uniform void of 1/2"-3/4" to the top of the fibers.
- H. At near Substantial Completion of the synthetic turf fields, the turf contractor shall test for shock absorbency. The turf contractor and/or manufacturer shall pay for an independent testing laboratory accredited for such tests (who shall be pre-approved by the Owner). All testing and analysis of findings shall be completed by qualified persons utilizing correct techniques. The laboratory shall provide the necessary testing data to the Owner that verifies the finished field meets or exceeds the required shock attenuation. The G-max range shall be between 95 and 160 for the life of the warranty, as determined by the ASTM F355A and F1936 test procedures. Any test results that do not meet the requirements of this specification or if any one test value is greater than ten percent (10%) greater in variance as specified, then the Contractor's field installer shall address the failed test area, be required to retest the entire field as stated above, and conform to these requirements prior to the issuance of the Certificate of Substantial Completion.
- I. Upon completion of installation, the finished field shall be inspected by the District, installation supervisor and manufacturer.

6.03 FIELD MARKINGS AND DECORATIONS

- A. Field markings and decorations shall be installed in accordance with approved project shop drawings.

- B. Non-tufted or inlaid lines and markings shall be painted in accordance with turf and paint manufacturers' recommendations. Number of applications will be dependent upon installation and field conditions.

6.04 CLEAN UP

- A. Do not permit traffic over unprotected surface.
- B. Turf Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.
- C. All usable remnants of new material shall become the property of the Owner.
- D. The Turf Contractor shall keep the area clean throughout the project and clear of debris.
- E. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.
- F. Protect installation throughout construction process until date of final completion.

6.05 OTHER MATERIALS AND EQUIPMENT

- A. Maintenance Equipment
 - 1. Provide one (1) towed, non-powered Turf Sweeper with hitch, excluding prime mover vehicle. The sweeper attachment shall be of sufficient size to cover a 36" wide swath in a single pass. The sweeper attachment shall be fitted with synthetic bristle brushes as recommended by the synthetic turf manufacturer and shall be used primarily to collect surface debris.
 - 2. This document is for illustrative purposes and may change without notice. Purchaser should verify that a representative specification of the system to be installed has been received prior to the establishment of a project or contract.

6.06 FIELD MAINTENANCE

- A. Perform regularly scheduled periodic maintenance every year. The maintenance will include but not be limited to a complete inspection and repair including all materials and cleaners of all areas of the field including: Fiber fibrillation analysis, Seam analysis, Perimeter anchoring, Excessive wear analysis, UV fade inspection, Infill – consistency in depth, Infill – migration analysis, Glued inlay analysis, Base stability analysis, Painted marking inspection, Debris removal, Brushing, Aerating, Grooming, Removal of weeds and moss, Removal of stains, Keeping the infill level.
- B. The inspection and maintenance will be performed by an Authorized Maintainer, if the person is not the same as the previous visit, then credentials will be submitted for approval before the visit.
- C. Approximate number of times is 1 visit per year for 8 years through the warranty period.

6.07 WARRANTY

- A. The turf installer and/or the turf manufacturer must provide the following prior to Final Acceptance and the Owner filing the Project Notice of Completion:

1. The turf manufacturer shall provide the written warranty for the project per the minimum requirements identified in this specification section. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer and Insurance Carrier. Submit information confirming that the third party insurance policy, non-cancelable and pre-paid, is in effect covering this installation, and underwritten by a Best "A" Rated Insurance Carrier. Insurance carrier must confirm that the policy is in force and premiums paid.
2. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventive maintenance of the turf system, including painting and markings.
3. Project Record Documents: Record actual locations of seams and other pertinent information.
4. Upon completion of the field installation, the turf installation contractor shall have a supervisory personnel provide a minimum three (3) hour field training seminar with the Owner on how to care for the field. At a minimum, seminar shall include a demonstration of how to care for the field with the provided groomer / sweeper address use of the sweeper and groomer, review the entire provided maintenance manual (including the proper procedure for removal of gum and other debris) and answer any questions.
5. Supply a field groomer and/or sweeper as specified.

END OF SECTION 32 18 13

**SECTION 32 18 14
SYNTHETIC TURF BASE**

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor's scope of work includes site preparation, excavation, disposal of excess or unsuitable material, subgrade grading, installation of subsurface drainpipe and perimeter header, and the selection, purchase, grading and compaction of permeable material in accordance with the lines, grades, and cross-sections shown on the drawings.

1.02 RELATED SECTIONS

- A. Section 01 45 00 – Quality Control
- B. Section 01 50 50 – Erosion Control
- C. Section 31 20 00 – Earth Moving
- D. Section 31 23 33 – Trenching and Backfilling
- E. Section 31 23 00 – Excavation and Fill
- F. Section 32 11 00 – Base Course
- G. Section 32 18 13 – Synthetic Turf

1.03 QUALITY ASSURANCE

- A. Reference Standards - ASTM: American Society for Testing and Materials.
- B. Contractor's Materials Testing Agency Qualifications: An independent testing agency qualified to conduct soil materials and rock-definition testing that complies with ASTM E329 or D3740 and has personnel with at least 5 years of experience performing the following ASTM standard test methods and practices.
 - 1. D75: Standard Practice of Sampling Aggregates.
 - 2. ASTM C88 - 05 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 - 3. C125: Standard Terminology Relating to Concrete and Concrete Aggregates
 - 4. C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 5. C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 6. C702: Standard Practice for Reducing Samples of Aggregate to Testing Size.
 - 7. D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

8. D2167: Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 9. D2434: Standard Test Method for Permeability of Granular Soils (Constant Head).
 10. D4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 11. D5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
 12. D6938: Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- C. Owner's Testing Agency shall review Contractor's submittals under this specification and recommend action as defined under Section 01 33 00 – 1.2.1 Submittal Procedures.
- D. The Owner shall reject material delivered to the site not meeting specifications. All material rejected by the Owner shall be removed from the site and replaced with suitable material at the Contractor's expense.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store all products to be installed as part of the field base neatly and orderly, stacked and blocked to prevent damage. Cracked, warped, uneven, or otherwise damaged material shall be removed from the site.

1.05 PROJECT CONDITIONS

- A. Contractor shall be responsible for stabilizing all top of subgrade elevations for the synthetic turf areas prior to receiving the stone aggregate base and for executing any fine grading as may be necessary or incidental to placement of the synthetic turf.
- B. The stone base shall not be contaminated with other soil. Contaminated stone material will be rejected. In addition, if at any time the stone material is tested at the site and is not in compliance with the specifications, Contractor shall remove all material not in compliance with the project specifications at its sole expense and replace it with material that conforms to the Contract Documents.
- C. Contractor to prevent surface water and subsurface or groundwater from flowing into excavations and flooding project site and surrounding area. Contractor must not allow water to accumulate in excavations. Contractor shall remove water to prevent softening of sub grades.

1.06 SUBMITTALS

- A. Conform to requirements of Section 01 33 00 Submittals and/or applicable Division One and Division Two specifications, General Conditions and Special Provisions.
1. Submit product data on pipe accessories, filter fabric, and porous drainage composite as applicable.
 2. Submit manufacturer's installation instructions.
 3. Certification: Submit certification signed by Contractor and drainage system Installer that installed materials conform to specified requirements and system was successfully checked and tested prior to covering with drainage sand or gravel aggregate.

4. Submit two one quart samples of each rock material to the Architect, and one five gallon sample of each rock material to the District's testing agent.
5. Submit certification signed by the Contractor's Synthetic Turf Installer stating that they have visited the site and observed the initial placement and compaction of a test area of permeable stone and find the surface suitable to install the synthetic turf. This submittal shall be received and approved by the Owner prior to placement of the permeable material.
6. Project Record Drawings:
- 7.
8. Conform to Section 01 78 39 and/or applicable Division One and Division Two specifications, General Conditions and Special Provisions.
9. Accurately record locations of utilities remaining, re-routed utilities, new utilities, and newly discovered utilities by horizontal dimensions, elevations, inverts, and slope gradients.

1.07 MATERIAL TESTING

- A. The Owner's Testing Agent will be present intermittently to observe the Contractor's operation, to perform tests and measurements. Such observations, tests, measurements shall not alter the requirements of the drawings or specifications nor imply any superintendence or control of the Contractor's operation, nor warranty the Contractor's work.
- B. During construction, the Contractor shall perform their own inspection and testing by Contractor's Materials Testing Agency or Rock Manufacturer on rock materials to the degree they deem necessary to assure compliance of the rock materials with the specifications. This inspection and testing shall be in addition to that which is specifically required by this specification.
- C. Testing of proposed base rock (which includes all rock materials outlined in this specification section) will be performed in the following steps:
 1. For Porous Rock Bases:
 - a. Pre-construction Testing: Contractor shall submit a five-gallon separate composite (the District's Testing Agent may elect to pull the sample directly at the quarry, and may also want the test samples or varying quantity based on the testing labs' needs) of each porous base rock material. The District's testing agent will evaluate these materials using ASTM C136 and ASTM D75 testing protocol as a guideline. This representative sample will be used for comparison with all subsequent samples submitted for acceptance during construction.
 - b. Testing During Construction: The District's Testing Agent shall obtain a five-gallon composite sample (project geotechnical engineer may elect to pull the sample directly at the quarry, and may also want the test samples or varying quantity based on the testing labs' needs) of all base rock materials at the rock source representing each 500 tons per site of crushed permeable field rock. Material shall not be delivered to the project site until tests show it complies with the accepted material.
- D. Payment for initial material testing is the responsibility of the District. Any test, which must be repeated on materials that have failed to meet specifications or are as a result of shortages, will be borne by the Contractor.
- E. The testing reports shall be submitted to the District for approval ten (10) calendar days prior to scheduled placement on the synthetic turf subgrade.

PART 2 - PRODUCTS

2.01 NONWOVEN GEOTEXTILE

- A. Nonwoven geotextile (Filter Fabric) placed in the subsurface drainage trenches shall conform to the following specifications.

<u>Mechanical Properties</u>	<u>Test Method</u>	<u>Unit</u>	<u>Min. Ave. Roll Value</u>
Grab tensile strength	ASTM D4632	lbs	120(MD), 120(CD)
Grab tensile elongation	ASTM D4632	%	50(MD), 50(CD)
Trapezoid tear strength	ASTM D4533	lbs	45(MD), 45(CD)
CBR Puncture strength	ASTM D6241	lbs	300
Apparent opening size	ASTM D4751	mm	0.20
Flow rate	ASTM D4491	gal/min/ft2	130

2.02 WOVEN GEOTEXTILE

- A. Woven geotextile (Separation Fabric) placed on the subgrade shall conform to the following specifications.

<u>Mechanical Properties</u>	<u>Test Method</u>	<u>Unit</u>	<u>Min. Ave. Roll Value</u>
Tensile Strength (ultimate)	ASTM D4595	lbs/ft	2000(MD), 1500(CD)
Grab tensile strength	ASTM D4632	lbs	250(MD), 250(CD)
Grab tensile elongation	ASTM D4632	%	20(MD), 20(CD)
Trapezoid tear strength	ASTM D4533	lbs	100(MD), 50(CD)
CBR Puncture strength	ASTM D6241	lbs	500
Apparent opening size	ASTM D4751	mm	0.30
Flow rate	ASTM D4491	gal/min/ft2	30

2.03 DRAINAGE SYSTEM

- A. Refer to storm drain specifications for in-field drainage elements.

2.04 SUBDRAIN TRENCH DRAIN ROCK

- A. Shall be ¾” x ½” crushed virgin (i.e. un-recycled) rock, and shall meet the following general gradation requirements:

<u>Sieve Size</u>	<u>%PASSING</u>
1”	100
¾”	90-100
½”	10-40
⅜”	0-15
#4	0-5

- B. The rock profile will extend from the bottom of the trench to the top of both sides of the subdrain trench, and to the top of rock elevation. **The permeable base rock shall not be installed over the subdrain trench drain rock.** For planarity purposes, a clean uniform 3/8” minus crushed stone material may be installed over the subdrain trench profile (max thickness one inch for this stone layer)

2.05 CRUSHED PERMEABLE STONE

- A. The synthetic turf permeable stone base may consist of either one uniform stone material or a dual stone profile, as described below.
- B. For the section of permeable rock outside the subdrain trench within the field areas, the Contractor shall use the following rock:
 1. One uniform permeable rock base material beneath the synthetic turf that shall be a virgin (i.e. un-recycled) crushed stone. It shall meet the gradation criteria for the California Department of Transportation 3/4" Permeable Class II (Section 68):

<u>Mesh size</u>	<u>% Passing</u>
1"	100
3/4"	90-100
3/8"	40-100
#4	25-40
#8	18-33
#30	5-15
#50	0-7
#200	0-3

The Contractor is responsible for ensuring whatever type of rock and blend they submit and install will meet all the stated requirements in **item 1.08** in this section.

PART 3 - EXECUTION

3.01 GENERAL

- A. Excavating and grading shall be performed in conformance with the alignment, grade and cross-sections indicated on the drawings.

3.02 SUBGRADE SLOPES AND GRADE TOLERANCES

- A. Final subgrade grades shall conform to the lines and grades shown on the drawings.
- B. Subgrade shall be free of debris, non- compactable material, topsoil, or organics prior to beginning work.
- C. The subgrade shall be excavated to create a positive slope towards the subsurface drainpipes. Unless otherwise specified on the drawings, the minimum slope of the subgrade shall be 0.7%.

- D. The final subgrade grade shall be rolled with a smooth drum roller to remove all localized depressions deeper than ½ inch caused by construction and compaction equipment tires or rollers.
- E. The measured grades shall not deviate more than 0.08 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Top of subgrades shall be verified. Laser grading is required.
- F. All subgrade grades shown on the drawings shall be completed by the Contractor and inspected by the Owner and Engineer prior to commencing with the subsequent work items.
- G. A conformance survey shall be performed by a licensed surveyor in accordance with Section 01 07 00 - Conformance Surveying.
- H. Once the subgrade conformance has been accepted and compaction has been properly achieved, the geotextile filter fabric shall be installed over the compacted and prepared subgrade, as shown on the plans, without disturbing grades.
- I. Geotextile fabric shall be installed with 6” overlap and stapled 6’ on-center along seams. Staples to be 6” staples.

3.03 SUBSURFACE DRAINAGE SYSTEM

- A. A system of shallow trenches shall be excavated to the lines, grades and dimensions shown on the drawings.
- B. The excavated trenches shall be free of loose soil and debris.
- C. Contractor to protect all drain trenches to ensure that pipe is not damaged in any way by construction operations and that the rock is not contaminated with any native soils, unintended construction material, or deleterious materials during subsequent construction operations.
- D. A layer of filter fabric shall be placed in the shallow trench and backfilled with at least 2 inches of washed virgin ¾-inch drainrock or CalTrans Class 1B permeable material. A perforated drain pipe shall then be placed in the trench in accordance with the drawings. The pipe shall be laid with the perforations down and at a minimum slope of 0.5% unless otherwise specified on the drawings. Lengths of pipe shall be joined by fittings fabricated by the pipe manufacturer. The perforated drain pipe shall be covered with at least 2 inches of washed virgin ¾-inch drainrock or CalTrans Class 1B permeable material.
- E. All trench rock backfill shall be placed in layers eight inches or less in loose thickness and compacted to achieve at least 90% of the maximum density (ASTM D4253).
- F. Solid pipe clean out risers with end caps shall be installed at locations designated on the drawings. The long bend “sweeping” 90-degree bends, or two consecutive 45-degree bends, should be utilized for the subdrain cleanouts.
- G. The perforated sub-drain pipes shall connect to a non-perforated discharge pipe. The discharge pipe shall connect into the storm water drainage system as shown on the drawings.

3.04 GEOTEXTILE

- A. Geotextile shall not be installed until a perimeter header has been installed.
- B. Geotextile shall not be installed until subdrainage trenches have been excavated.
- C. Geotextile rolls shall be handled in such a way that they are not damaged.
- D. Geotextile shall be placed on exposed subgrade surfaces in accordance with the drawings. The geotextile shall be rolled out parallel to the long direction of the playfield.
- E. Geotextile shall be securely anchored and then rolled in such a manner as to continually keep the geotextile sheet in tension.
- F. Geotextile seams shall be anchored using 60d nails through 1-1/2" round washers placed at 36 to 48 inches on center during placement. Additional anchoring shall be installed as required to prevent bunching of the geotextile.
- G. Adjacent widths of geotextile shall be "shingled" and have a 6-inch overlap at all edges.
- H. Holes or tears in the geotextile shall be repaired with a fabric patch spot-seamed with a minimum 24 inch overlap in all directions.
- I. Impervious liners shall be installed in accordance with the mfr's recommendations.

3.05 POURIOUS STONE BASE

- A. The Contractor's Synthetic Turf Installer shall observe the initial placement and compaction of permeable stone in a 20-foot by 20-foot trial area and determine whether the surface is suitable to install the synthetic turf. The Contractor shall modify installation procedures and/or material used until the Contractor's Synthetic Turf Installer is satisfied.
- B. Should any segregation of the material occur, during any stage of the stockpiling, spreading or grading, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation.
- C. The crushed stone must be laid without damaging the soil subgrade (and the in-field drainage system as applicable). It is very important to not create any depressions with heavy equipment. The specified stone or aggregate supplied must conform to the recommended specifications. The finished crushed stone or aggregate base supplied must be stable, unyielding, and permeable.
- D. The crushed stone shall be carefully and evenly spread over the subgrade and up both sides of the subdrain trenches to the depth shown on the plans.
- E. The specified permeable stone shall be carefully placed and compacted over the subgrade to the grades and elevations shown on the drawings. If the thickness of the planned permeable stone exceeds 8-inches, the rock shall be placed in horizontal layers not exceeding 8 inches and each layer compacted to 90% of the maximum density to firm and unyielding surface with a vibratory smooth drum roller.
- F. Excess water shall not be applied during installation of rock base and rough grading due to the potential of softening the subgrade and altering the grading.

- G. Crushed stone shall be smoothed and compacted uniformly to design grades by alternating raking, water settling, and rolling operations. Contractor shall be advised not to overwork the stone material, thus modifying its gradation characteristics. Minimal rolling is advisable to achieve design grades and compaction. Only static (absolutely no vibratory rolling of the permeable stone is allowed) rolling is allowed, and max 3-5 ton rollers should be used on the permeable stone base.
- H. Top of porous rock elevations and slopes shall be verified using laser-operation survey instruments. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.02 feet in 10 feet in any direction. Refer to Conformance Surveying specifications for requirements.
- I. The final grade shall be ideally compacted to a uniform 90 - 92% relative compaction. Contractor shall be advised not to overwork the stone material, thus modifying its gradation characteristics. Minimal moving of the stone upon placement of the material on the subgrade and rolling is advisable to achieve design grades and compaction. Compaction shall not be above 92%.
- J. Top of rock elevations shall be verified using laser-operation survey instruments. Refer to Conformance Surveying specifications for requirements.
- K. Contractor shall manually screed the top stone surface to ensure tolerances are met. Finish surface planarity shall be verified, and if necessary adjusted, by the Contractor using string line method. A mason's line held taught between two workman separated by a distance of approximately 40 feet, shall be placed directly on the finished surface, parallel to the direction of greatest slope. A third workman shall check for separations between the mason's line and the finished surface that are equal to or greater than the specified tolerances. Areas of separation shall be outlined with marking paint and the depth of separation indicated.
- L. Entire finished surface shall be "walked" with mason's line in increments of approximately 3 feet.
- M. Areas outlined with marking paint shall be filled with top rock to the depth indicated and raked by hand. Filled areas shall be compacted to provide a non-yielding, smooth, flat surface.
- N. Final finished surface planarity shall be approved by the District and the Synthetic Turf Installer.
- O. Once the top of the permeable rock base is installed and compacted, the Contractor shall notify the District Testing Agent that it is ready for the field permeability test. The Agent shall be given two working days notice and have 2 days to complete the in field test, which will consist of a minimum of four controlled field permeability tests per synthetic turf field. Tests shall be by a single ring infiltrometer or equivalent test method. If the test does not achieve a minimum of 20 inches per hour, the Contractor shall provide within 48 hours a written repair procedure to correct the permeability deficiency. All repair work, including any associated delays, shall be the Contractor's sole responsibility. Any fine tuning of the field base due to the testing operations is the responsibility of the Contractor.
- P. Permeable stone grades shall be completed by the Contractor and inspected by the Owner and Engineer prior to commencing with the subsequent work items.

3.06 INSTALLATION OF MANUFACTURED COMPOSITE BASE MATERIAL

- A. Upon successful completion of installing the base, the porous composite base material shall be installed per the Contract Drawings and in strict compliance with the manufacturer installation instructions. Contractor to exercise extreme care in order to avoid disturbing the crushed stone base.
- B. Contractor to take measures to ensure that the product is not exposed to the outdoor elements longer than the manufacturer's recommendations. Any product that exceeds this time duration shall be removed from the project site immediately and not used on the project.
- C. All sections of the material shall be interlocked and/or connected to adjacent pieces of the base material in strict conformance with the manufacturer's written recommendations.

END OF SECTION 32 18 14

SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions of the Contract, including General and Special Provisions and General Requirements apply to the work in this section.

1.02 DESCRIPTION

- A. Work included: Furnish all labor, materials, equipment, facilities, transportation and services to complete all metal fencing and related work as shown on the drawings and/or specified herein and as necessary for a complete installation.

1.03 SUBMITTALS

- A. Submit complete shop drawings of all fencing prior to manufacturing.

1.04 PRODUCT STORAGE

- A. Store materials, either plain or fabricated, above ground on platforms, pallets, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

PART 2 - PRODUCTS

2.01 METAL FENCE

- A. Tubular steel fence shall be as per plans, details, and as specified herein.

PART 3 - EXECUTION

3.01 INSTALLATION OF FENCING

- A. Weld all shop connections. Welds shall be smooth, continuous beads, free to excessive roughness and spatter. Grind surface welds smooth and flush to match and blend with parent metal surfaces. Rail fences shall be completely constructed in the field. No pre-welding of rails to posts shall be permitted.
- B. Finish: Rust proofing and priming shall be done in the factory by the manufacturer according to the manufacturer's specifications. After installation of fence and grinding of welds, grease, oil dust and mud shall be removed by washing with mineral spirits. Rust and loose mill scale shall

be removed from unprimed metal by sandblasting or wirebrushing to expose bare metal. Prime coat shall be applied immediately on the same day to prevent corrosion. Factory primed metal shall be examined and any abraded or bare areas shall be spot primed. Primer shall be zinc chromate type appropriate for exterior use on ferrous materials.

- C. Finish paint shall be field applied by the electrostatic spray method. Use airless spray guns and apply each coat to provide the equivalent hiding of brush-applied coats. Do not doubleback with spray equipment for the purpose of building up film thickness of two coats in one pass. Finish coats shall be compatible with the prime paints. Finish paint shall be two coats of exterior grade semi-gloss enamel paint. Color shall be as specified on plans.
- D. Posts: Terminal, corner and line posts shall be as indicated on plans.

Height: Height shall be as indicated on plans.
- E. The work shall be laid out according to the dimensions on the plans.
- F. Post Spacing: Line posts shall be placed 8'-0" on center maximum unless otherwise noted.
- G. Post footings shall be minimum 3'-0" deep. Slope top to drain away. Top of footing shall be minimum 6" below finished grade in planting areas.

3.02 POST SETTING

- A. All posts shall be set in holes of diameter and depth as indicated on the plans. After the post has been set and plumbed, the holes shall be filled with a mix of 564 pounds of Portland Cement per cubic yard of concrete. The exposed surface of the concrete shall be crowned to shed water and troweled smooth. No dry mixing on site will be permitted.

END OF SECTION 32 31 19

SECTION 32 84 00
RECLAIMED WATER IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

1.02 DESCRIPTION

- A. Contractor shall furnish all labor, tools, equipment, product, materials and transportation and perform all operations necessary to properly execute and complete all work in accordance with the Drawings and these Specifications. The intent is to accomplish the work of installing an irrigation system, which will operate in an optimum manner. This intention is to be met foregoing any deficiency in setting a complete detailed description of the work to be done.
- B. Related Work Specified Elsewhere:
1. Section 32 91 19: Earthwork and Site Grading
 2. Section 32 90 00: Landscape Planting
 3. Division 15: Mechanical
 4. Division 16: Electrical

1.03 QUALITY ASSURANCE

- A. Reference Standards:
1. ASTM: American Society for Testing and Materials
 - a. D1785: Standard Specification for polyvinyl chloride (PVC) plastic pipe, Class 200, Class 315.
 - b. D2446: Standard Specification for polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40 and Schedule 80.
 2. NSF: National Sanitation Foundation
- B. Drawings:
1. For purposes of clarity and legibility, drawings are essentially diagrammatic to the extent that many offsets, bend, unions, special fittings, and exact locations of items are not indicated, unless specifically dimensioned.
 2. Exact routing of piping, etc., shall be governed by structural conditions, obstructions. Contractor shall make use of data in Contract Documents.
 3. The contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that unknown obstructions, grade difference or discrepancies in area dimensions exist that might not have been considered in engineering. Such

obstructions or differences shall be brought to the attention of the irrigation consultant. In the event this notification is not performed, the contractor shall assume full responsibility for any revision necessary.

1.04 VISIT TO THE SITE

- A. The contractor shall visit the construction site and shall take all measurements and obtain any other information as may be necessary for a complete and conclusive bid.

1.05 SUBMITTALS

- A. Substitutions: Prior to installation, any proposed substitution from the plans or these specifications is to be forwarded, in writing, to the irrigation consultant for approval.
- B. Record Drawings: Provide record drawings as follows:
 - 1. The contractor shall maintain in good order in the field office one complete set of prints of all sprinkler drawings, which form a part of this contract. In the event any work is not installed as indicated on the drawings, such work shall be indicated and dimensioned accurately on record drawings as changes occur. Dimension from two permanent points of reference, building corner, sidewalk, road intersections, etc., the location of the following items.
 - a. Connection to existing water lines
 - b. Connection of existing electrical power
 - c. Routing of pressure lines (dimension max. 100 feet lone along routing)
 - d. Electrical control valves
 - e. Routing of control wires
 - f. Quick-coupling valves
 - g. Underground stub-outs
 - h. Other related equipment as directed by the irrigation consultant
 - 2. Upon completion of the work, obtain reproducible mylar from the landscape architect and neatly correct the plans (to be done by a competent draftsman) to show the as-built conditions. After the as-builts are reviewed and approved by the irrigation consultant, obtain reduced copies of "as-built" mylar (11" x 17" sheets or to the smallest readable size that will fit into controller), and laminate with weather proofing coating as specified below to be used as controller charts.
- C. Controller Charts: The Contractor shall provide color coded controller charts, one (1) for each controller, reduced in size from original drawings and containing the same plan information as as-built drawings which shall be placed on the inside face of each controller enclosure door. Record as-built drawings from which the charts are to be made shall be approved by the Engineer prior to preparing the charts.

Each chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow. Items on the controller chart shall include:

1. Connection to existing water lines.
2. Routing of pressure lines.
3. Routing of control valves.
4. Locations of remote control valves, gate valves, and quick coupling valves.
5. Other related equipment as directed by the Project Engineer.

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, irrigation symbols shall be enlarged to a size that will be readable when reduced.

The chart shall be a black line or blue line ozalid print, and a different color shall be used to indicate the area of coverage for each station.

When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 mils.

These charts shall be completed and approved prior to final inspection of the irrigation system.

After the system has been completed, the Contractor shall instruct the Engineer in the operation and maintenance of the system and shall furnish a complete set of operating instructions prior to final acceptance.

D. Operation and Maintenance Manuals:

1. Prior to the final inspection of the irrigation system, furnish two (2) individually bound Service Manuals to the owner. The manuals shall contain the following:
 - a. Index sheet indicating the contractor's name, address, and phone number.
 - b. A copy of the completed guarantee-following the form in these specifications.
 - c. Certificate of insurance verifying coverage for completed operations.
 - d. List of equipment with names, addresses and telephone numbers of all local manufacturers' representatives.
 - e. Copies of equipment warranties and certificates.
 - f. Complete operating and maintenance instructions of all equipment including exploded drawings and spare parts list.
2. Provide instruction in operation of system to owner's personnel.

E. Hardware Items:

1. Two (2) sets of matching Q.C.V. keys and hose swivels.
2. Two (2) keys to each controller box.
3. Two (2) sets of any special tool required for the maintenance of each type of component used in the sprinkler system.

1.06 PROJECT COORDINATION

- A. Sequencing and Scheduling: Coordinate irrigation installation work with the installation of other site improvements, including utility installation work and landscape installation.
- B. Environmental Conditions: Site work such as trenching and backfilling shall not be performed during wet, muddy or frozen conditions.
- C. Rules and Regulations: All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code, Title 22 of the California Code of Regulations, the Uniform Plumbing Code and all other local governing codes, rules or regulations. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes.
 - 1. The contractor shall furnish any additional material and labor required to comply with these rules and regulations, though the work is not mentioned in these particular specifications or shown on the drawings.
 - 2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.
- D. Safety:
 - 1. The contractor shall erect and maintain barricades, guards, warning signs, and lights as required for the protection of the public and workmen.
 - 2. All work shall be performed in a safe manner. All regulations, all OSHA requirements and other authoritative agencies shall be followed. Special regulations apply for the usage of recycled water. Refer to the state department of health services “guidelines for worker protection” and “guidelines for use of recycled water” for more information.
 - 3. Prior to commencement of work, locate all underground utilities so that proper precautions may be taken not to damage such improvements.
- E. Maintaining Traffic: It is the responsibility of the contractor to ensure adequate protection and controls for pedestrian and vehicular traffic in the vicinity of the project areas. The contractor shall provide all signs, barricades, flagmen, etc., necessary to meet all traffic requirements for this project at his own expense.
- F. Permits and Fees: The contractor shall obtain all permits and pay all required fees to any governmental agency having jurisdiction over the work and arrange for inspections specified by local ordinances during the course of construction as necessary.

PART 2 - PRODUCTS

2.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling of pipe and fittings: The contractor is cautioned to exercise care in handling, loading, unloading, and storing of pipe and fittings. Cracks can occur from sudden impact. Protect all plastic products from excessive exposure to sunlight. Any section of pipe that has been dented or damaged shall be removed from the site and, if installed, shall be replaced with new undamaged piping.

2.02 MATERIALS

- A. PVC Pressure main line piping and fittings:
1. Pressure main line piping: 2 ½” and larger 1120-Class 315 PVC plastic pipe. 2” and smaller 1120-Schedule 40 PVC plastic pipe. All pipe shall be colored purple for the use of recycled water.
 2. Pipe shall be made from NSF approved, Type 1, Grade 1 PVC compound conforming ASTM D1784. All pipe shall meet requirements set forth in ASTM D2441 with an appropriate standard dimension ratio.
 3. All PVC pipe shall bear the following markings:
 - a. Manufacturer’s name
 - b. Nominal pipe size
 - c. Schedule or class
 - d. Pressure rating in PSI
 - e. NSF
 - f. Date of extrusion
 - g. All pipe shall be marked with the words “CAUTION: RECYCLED WATER – DO NOT DRINK” or similar printed continuously on two (2) sides of the pipe.
 4. All fittings shall bear the manufacturer’s name or trademark, material designation, size, applicable I.P.D. schedule and NSF seal of approval.
- B. PVC non-pressure lateral line piping and fittings:
1. Non-pressure buried lateral line piping shall be PVC 1120 Class 200 with solvent-weld joints. All pipes shall be colored purple for the use of recycled water.
 2. Pipe shall be made from NSF approved, Type 1, Grade 1 PVC compound conforming to ASTM D1784. All pipes shall meet requirements set forth in ASTM D2441 with an appropriate standard dimension ratio.
 3. Except as heretofore specified, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as specified.
- C. Sleeving and Conduit: Material shall be polyvinyl chloride (PVC) Schedule 40, type 1120/1220 with solvent weld.
- D. Galvanized steel pipe shall be Schedule 40; ASTM (A120) and steel fittings shall be Schedule 40 hot dipped, double banded malleable steel.
- E. PVC Schedule 80 nipples shall be used with molded threads. Machined threaded nipples will not be allowed.
- F. Connections between supply line and R.C.V.'s shall be as specified or detailed on the drawings.
- G. Riser assemblies shall be as specified or detailed on the drawings.
- H. Controller(s), valves, and sprinkler heads shall be specified and/or detailed on the drawings.

- I. Control wires shall be UL approved copper single strand type UF direct burial 14 gauge red in color. Common wires shall be UL approved copper single strand type UF direct burial 12 gauge white in color. Spare control wires shall be UL approved copper single strand type UF direct burial 14 gauge blue in color.
- J. Miscellaneous installation materials:
 - 1. Solvent weld joints shall be of make and type approved by manufacturer (s) of pipe and fittings. Solvent cement shall be a proper consistency throughout use. Mixing thinner with solvent will not be allowed.
 - 2. Pipe joint compound shall be non-hardening, non- toxic materials designed specifically for use on threaded connections in water carrying pipe.
 - 3. Wire connections shall be 3M #3750 Scotch Lok Seal Packs, Spears DS-400 seal packs or approved equal.
- K. Thrust Blocks: Concrete thrust blocks shall be as detailed on the plans.
- L. Control or Valve Boxes:
 - 1. Provide 14 x 19 inch plastic rectangular control valve box with bolt down plastic lid for each electrical control valve. Hot stamp or permanently engrave irrigation controller station number onto valve box lid. Valve boxes and lids shall be colored purple for the usage of recycle water.
 - 2. For gate valves and quick coupling valves: Use 9-inch plastic round box. Add extensions for gate valves as required. Hot stamp or permanently engrave "GV" for gate valve and "QCV" for quick coupler valves onto valve box lid. Valve boxes and lids shall be colored purple for the usage of recycled water.

PART 3 - EXECUTION

3.01 GENERAL

- A. Irrigation system shall be installed in accordance with all applicable local and state codes and ordinances by a licensed landscape contractor.
- B. Follow manufacturer's direction except as shown or specified.

3.02 INSPECTION OF SITE CONDITIONS

- A. All scaled dimensions are approximate. The contractor shall check and verify all size dimensions prior to proceeding with work under this Section.
- B. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.
- C. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, and groundcover.

- D. Avoid trenching within drip line of trees where possible. When not possible, all damaged roots over 1-1/2" in diameter shall be cut leaving clean face, seal cuts with tree seal, then immediately install pipe, wire, etc., refill trench and soak.
- E. The contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the irrigation installation.
- F. Coordinate the work of this Section with that of other Sections for the location of pipe sleeves through walls, paving, etc.
- G. The landscape contractor shall verify water pressure and available gallonage prior to construction. If deficiencies are noted that will hinder the system's performance, notify the irrigation consultant for directions to correct deficiencies.
- H. The design is diagrammatic. All piping, valves, etc., shown within paved areas is design clarification only. Install piping, valves, etc., in planting areas.

3.03 PREPARATION - LAYOUT OF WORK

- A. Prior to installation, stake out all pressure supply lines, routing and location of sprinkler heads and notify irrigation consultant for reviewing layout when area or grade differences or obstructions are not as indicated on the plans.

3.04 INSTALLATION

- A. Trenching:
 1. Dig trench straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout shown on drawings.
 2. Provide for a minimum of 18 inches cover for all pressure supply lines.
 3. Provide for a minimum cover of 12 inches for all non-pressure lines to spray heads.
 4. Provide for a minimum cover of 18 inches for all control wiring.
 5. Provide a minimum cover of 24 inches over pipe and wiring under asphalt pavement.
- B. Backfilling:
 1. In accordance with requirements of SECTION 31 23 00, "EXCAVATION AND BACKFILLING".
 2. Do not backfill trenches until all required tests are performed. Carefully backfill trenches with specified excavated materials for backfilling, consisting of earth, loam, sandy clay, sand, or other acceptable materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
 3. Surround pipe with sand in rocky terrain with a 4" bed and 4" cover.
 4. Backfill in proposed asphalt paved areas shall have sand covering pipe with a 6" minimum depth.

- C. Pipe and Fitting Installation and Connections:
1. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
 2. Install all assemblies specified herein in accordance with details shown on drawings.
 3. Thoroughly clean PVC pipe and fittings of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
 4. On PVC to metal connections, the contractor shall work the metal connections first. Use Teflon tape, or equal, on all threaded PVC to PVC, and on all treaded PVC to metal joints.
 5. Install piping under existing walks by boring whenever possible. Where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced at no increase in contract sum. Obtain permission to cut or break sidewalks and/or concrete from the architect before proceeding. No hydraulic driving will be permitted under concrete paving.
- D. Line clearance: All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.
- E. Automatic Controller(s):
1. Locate controller(s) in general location(s) shown with exact placement to be determined at job site by the irrigation consultant or Owner's Representative.
 2. Connect control lines to controller(s) in sequential arrangement according to assigned identification number on plans.
 3. Controller(s) shall be properly grounded per Article 250 of the National Electric Code and conform to local regulations.
- F. Remote Control Valves: Install where shown on drawings. When grouped together, allow at least 12 inches between valves. Install each remote control valve in a separate valve box. Locate boxes in groundcover areas whenever possible, and a minimum of 12 inches from paving or curbs.
- G. Control Wiring:
1. Make connections between existing automatic controls and electrical control valves with direct burial copper wire. Common wires shall be white. Install in accordance with valve manufacturer's specifications and wire charts.
 2. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible. When not possible, house wiring in PVC conduit as described in "Sleeving and Conduit" section.
 3. Where more than one wire is placed in a trench the wiring shall be taped together at intervals of 10 feet.
 4. Provide 2-foot expansion coil at each wire connection and at least every 100 feet of wire length on runs more than 100 feet in length. Form expansion coils by wrapping at least five turns of wire around a 1-inch diameter pipe, then withdrawing the pipe.
 5. Splicing on runs shall be placed in junction boxes. Indicate all splices on the As-Built Plan.
 6. All below grade wire connections shall be made by using heat shrink tubing with interwall sealer following manufacturers recommended procedures.
 7. Install separate common wire for each controller. Install extra control wires of a different color through all valve boxes to controller as indicated in irrigation notes on plans.

- H. Sleeving and Conduit:
 - 1. Control wiring passing under proposed concrete and paving shall pass through Schedule 40 PVC conduit-size as required.
 - 2. Sleeving and conduit shall extend six (6") beyond farthest edge of pavement or curb.
 - 3. Provide removable non-decaying plug at ends of sleeves and conduits to prevent entrance of earth.
- I. Flushing of System:
 - 1. After all new pipelines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, open control valves and use a full head of water to flush out the system.
 - 2. Install sprinkler heads, bubblers and/or drip emitters only after flushing of system has been accomplished.
- J. Sprinkler Heads:
 - 1. Install sprinkler heads as shown on Drawings.
 - 2. Spacing of heads shall not exceed maximum shown on Drawings. In no case shall spacing exceed maximum recommended by manufacturer.
- K. Warning tags, Stickers and Labels.

3.05 FIELD QUALITY CONTROL

- A. Adjustment of the System:
 - 1. Flush and adjust all sprinklers for optimum performance and to prevent overspray onto walks, roadways and buildings.
 - 2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzles sizes and degrees of arc as required.
 - 3. Lowering raised sprinkler heads by the contractor shall be accomplished within ten days after notification.
- B. Testing of Irrigation System:
 - 1. Notify the irrigation consultant at least three (3) days in advance of testing.
 - 2. Test to be done at no extra cost to the Owner.
 - 3. Center load piping with sufficient amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
 - 4. Testing of pressure main lines shall occur prior to installation of electrical control valves.
 - 5. Pressure Test for Solvent Weld Pipes:
 - a. Apply test for solvent welded plastic pipe after joints have cured at least 4 hours or more it manufacturer of solvent cement requires.
 - b. Test supply lines per ASTM-F690 as follows: (1) add water slowly to pipe to avoid water hammer damage, (2) bleed system to insure all air is out of pipes, (3) pressurize system to 125PSI for two (2) hours. Visually inspect for leaks while

system is holding pressure constant. Note – use hydraulic pump or other safe method – do not use air compressor.

- c. Test sprinkler lines at line pressure and visually inspect for leaks.
6. When the irrigation system is completed, perform a coverage test to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviation from drawings. This test shall be accomplished before any plant material is planted.
7. Upon completion of each phase of work, test and adjust entire system to meet site requirements.

3.06 CLEAN-UP

- A. Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.

3.07 FINAL REVIEW PRIOR TO ACCEPTANCE

- A. Operate each system in its entirety at time of final review. Any items deemed not acceptable shall be reworked to the satisfaction of the irrigation consultant. Contact Landscape Architect at least 3 working days prior in advance to coordinate inspection.
- B. Final review shall take place after submission of all specified lists, record drawings, and manuals.
- C. Prior to approval of recycled water service, the prevailing water district shall perform a system inspection and cross connection test. Contractor shall assist the District inspector as necessary during the inspection and make necessary corrections to the irrigation systems as identified by the inspector.

3.08 INSPECTIONS

- A. The contractor shall be subject to inspections at any and all times by authorized representatives of the Owner.

3.09 MAINTENANCE

- A. The contractor is to make all repairs and maintain the entire sprinkler system from the time of installation through the landscape maintenance period.

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

WE HEREBY GUARANTEE THAT THE SPRINKLER IRRIGATION SYSTEM WE HAVE FURNISHED AND INSTALLED IS FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP, AND THE WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS. WE AGREE TO REPAIR OR REPLACE ANY DEFECTS IN MATERIAL OR WORKMANSHIP, ANY SETTling OF BACKFILLED TRENCHES, WHICH MAY DEVELOP DURING THE PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE AND ALSO TO REPAIR OR REPLACE ANY DAMAGE CAUSED BY ANY DEFECTS IN THE IRRIGATION SYSTEM OR RESULTING FROM THE REPAIRING OR REPLACING OF SUCH DEFECTS AT NO ADDITIONAL COST TO THE OWNER. ORDINARY WEAR AND TEAR, UNUSUAL ABUSE OR NEGLIGENCE ARE EXCEPTED. WE SHALL MAKE SUCH REPAIRS OR REPLACEMENTS, INCLUDING COMPLETE RESTORATION OF ALL DAMAGED PLANTING, PAVING, OR OTHER IMPROVEMENTS OF ANY KIND, WITHIN A REASONABLE TIME, AS DETERMINED BY THE OWNER, AFTER RECEIPT OF WRITTEN NOTICE. IN THE EVENT OF OUR FAILURE TO MAKE SUCH REPAIRS OR REPLACEMENTS WITHIN A REASONABLE TIME AFTER RECEIPT OF WRITTEN NOTICE FROM THE OWNER, WE AUTHORIZE THE OWNER TO PROCEED TO HAVE SAID REPAIRS OR REPLACEMENTS MADE AT OUR EXPENSE AND WE WILL PAY THE COSTS AND CHARGES THEREFORE UPON DEMAND.

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____

LICENSE NO: _____

ADDRESS: _____

TELEPHONE: _____

GUARANTEE TO: _____

DATE OF ACCEPTANCE: _____

AUTHORIZED REPRESENTATIVE: _____

END OF SECTION 32 84 00

SECTION 32 90 00
LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work to be Included:

1. Furnish all labor, materials, equipment, rentals, facilities, transportation, incidentals, excavations, submittals and services for installation of plant material and related work as shown on the drawings and/or specified herein including all topsoil, compost, headers, fertilizer, organic materials, plant materials, plant labels, tree stakes, mulch, maintenance, warranties and all other incidentals to planting work and as necessary for a complete and full installation of Landscape Planting.

B. Related Work:

1. Section 31 00 00 -- Earthwork: Close coordination shall be maintained with those Contractors performing rough grade operations and installing utilities and pavement to insure proper timing of the work.
2. Section 03 30 00 – Site Concrete Work
3. Section 32 84 00 – Irrigation: Irrigation system shall be installed and operative before beginning planting operation
4. Section 32 93 43 – Palm Trees

1.02 RELATED DOCUMENTS

A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

B. References:

1. Nomenclature: "Western Garden Book," Sunset Publishing Co., Menlo Park, CA, 2001 edition or current edition.
2. Plant Material Standards: "American Standard for Nursery Stock", American Nursery & Landscape Association, 1000 Vermont Avenue, NW Suite 300, Washington, DC, or current edition.
3. Staking and guying procedures: "Staking Landscape Trees", University of California Extension, Publication #2576, or current publication.
4. Pruning procedures: "Tree Pruning Guidelines", International Society of Arboriculture, Savoy, IL, 1995 or current edition, conforms to ANSI-A300-1995 tree pruning specifications and guidelines.
5. Manufacturer's recommendations.

1.03 REGULATORY REQUIREMENTS

- A. Perform work in accordance with all applicable laws, codes, and regulations required by the City of Santa Rosa and any other authorities having jurisdiction over such work. Provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

1.04 PERFORMANCE REQUIREMENTS

- A. Supervision: Assign a full-time employee to the job as Foreman for the duration of the Contract with a minimum of four (4) years experience in landscape installation. Foreman to be present during the entire installation. Notify City's Representative of all changes in supervision.

1.05 QUALITY ASSURANCE

- A. Personnel:
 - 1. All planting and turf work shall be performed by competent and efficient personnel familiar with planting and turf procedures under the supervision of a Qualified Foreman.
 - 2. Installing contractor shall have successfully completed within the last 3 years at least 3 planting applications similar in type and size to that of this project.
- B. Plant Material Standards:
 - 1. Plant Certification: All plants must meet specifications of Federal, State, and County laws requiring inspection for plant disease and insect infestations. Inspection certifications required by law shall accompany each shipment, invoice and order for stock.
 - 2. Codes and Standards: Nursery stock shall meet the standards of the current edition of the "American Standard for Nursery Stock", "Agricultural Code of California" and the "Regulations of the Director of Agriculture Pertaining to Nursery Stock". They shall be true to type and name in accordance with "Standardized Plant Names", Second Edition.
 - 3. Use only nursery-grown stock that is free from insect pests and diseases. Any required clearances shall be obtained prior to shipment of plant material.
 - 4. Plants shall be subject to inspection and approval of the Landscape Architect at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Wherever the terms "approve", "approval" or "approved" are used herein they mean approval of the Landscape Architect in writing.
 - 5. Contract Grown Plants: Contract grown plant material does not relieve the landscape contractor of providing materials which do not match or exceed standard nursery stock. Plants which do not meet standards shall be rejected and the Contractor shall provide nursery grown stock as required at no additional cost to the Owner or contract.

1.06 SUBSTITUTIONS

- A. Substitutions: Substitutions of plant materials will not be permitted unless authorized in writing by City's Representative. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Such proof shall be substantiated and submitted in writing to City.

- B. The Contractor shall submit a list of un-available plants per project plant list and a list of all nurseries and plant brokers contacted a maximum of **15** days after Notice to Proceed.
- C. The Landscape Architect reserves the right to require the Contractor to replace at the Contractor's cost any plants which the Contractor has installed without the Landscape Architect's approval.

1.07 PROOF OF PLANT AVAILABILITY

- A. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials. Contractor shall secure all material and provide proof of such within **30** days of Notice to Proceed in order to guarantee plant availability at time of planting. .
- B. Payment for the procurement of plant material, including possible incidentals such as storage and maintenance at nursery after purchase or contract growing plants, is the full responsibility of the Contractor.

1.08 SUBMITTALS

- A. All submittal data shall be forwarded in a single package to the City within 15 days of award of contract.
- B. Furnish 6 copies of manufacturers' literature for the following items:
 - 1. Plant Supplier's List:
 - a. Submit documentation to the City within **30** days of Notice to Proceed, that all plants listed on the plans have been ordered. Substitution of size or species due to unavailability must be requested in writing within **15** days of Notice to Proceed.
 - 2. Fertilizer
 - 3. Fertilizer Tablets
 - 4. Filter Fabric
 - 5. Turf Sod
 - 6. Organic Amendment
 - 7. Pre-Emergence Weed Killer
 - 8. Root Control Barriers
 - 9. Top Mulch
 - 10. Tree Support Poles
 - 11. Tree Ties
- C. Soil Testing: Provide soil analysis from an approved testing laboratory. Soil analysis using Saturate Media Analysis will not be allowed and rejected outright for soil analysis. Soil analysis shall include pH, salinity, sodium hazard, boron hazard, lime content, organic matter, soil texture and available nutrient levels. Submit test results, analysis, and recommendations for:
 - 1. Existing site topsoil (1 sample per acre)
Top Soil Analysis: After approval of rough grading and topsoil placement, obtain three representative samples of topsoil taken from approved site locations and submit to approved testing agency for "agricultural suitability" analysis report, including evaluation

of physical and chemical properties of soil and recommendations for adding amendment and fertilizers to the soil. Upon approval of the Laboratory's report by the City's Representative, the report recommendations become a part of the Specifications. Adjust the quantities of soil amendment, fertilizer and other additives to conform to the report.

2. Import top soil

Imported Top Soil Analysis: Submit sample to approved testing agency for "agricultural suitability" analysis report, including evaluation of physical and chemical properties of soil and recommendations for adding amendment and fertilizers to the soil. Upon approval of the Laboratory's report by the City's Representative, the soil and report recommendations become a part of the Specifications. Adjust the quantities of soil, soil amendment, fertilizer and other additives to conform to the report.

3. Imported Soil Fill

Imported Soil Fill shall fall within acceptable tolerances for plant fertility and suitability and shall have a pH value between 6 and 7.5. Imported soil fill that exceed acceptable levels for Macro and Micro – Nutrients for plants as indicated in soil laboratory testing will be rejected and shall not be used for project.

4. Organic Amendment.

D. Submit one (1) quart sample each of mulch and organic amendment.

E. Certificates of Compliance, receipts, and /or delivery tickets for the following:

1. Soil amendment, chemical and physical properties. Do not deliver amendment to the site without approval of submittals by City's Representative.
2. Quantity of soil amendment delivered to site for incorporation into soil.
3. Sod: Submit information from sod farm company, including type and percentage of seed mixture for approval by City's Representative.
4. All other soil amendments, soils, compost, and mulch delivered to the site.

1.09 ADDITIONAL SAMPLES AND TESTS

A. City's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by City's Representative. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.

1.10 SELECTION AND TAGGING OF PLANT MATERIAL

A. Contractor shall select and tag all plant material within **30** days of Notice to Proceed. Plant material which is not available, or not possible to contract grow shall be noted to the Landscape Architect within **15** days of Notice to Proceed so substitutions may be selected. Contractor shall source material from out of state or thru a plant broker if not locally available. Contractor shall submit lists of all nurseries and plant brokers contacted for availability.

B. Plants shall be subject to inspection and approval by City's Representative at place of growth if the City's Representative so chooses, and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Submit written request for inspection of plant material at place of growth to City's Representative.

Written request shall state the place of growth and quantity of plants to be inspected. City's Representative reserves right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

1.11 PROJECT SITE CONDITIONS

- A. Site Visit: At beginning of work, visit and walk the site with the City's Representative to clarify scope of work and understand existing project site conditions. Identify location of utilities and other improvements. Notify City's Representative of conflicts prior to start of work for resolution.
- B. Access: Inspect project site and become familiar with the accessing requirements and restrictions. At time of submitting bid, provide written notice of any conditions that would prevent installation of the specified plant material.

1.12 JOB CONDITIONS

- A. Delivery:
 - 1. Deliver manufactured materials in original containers with brand and maker's name marked thereon. Materials in broken containers or showing evidence of damage will be rejected and must be immediately removed from the site. Odorous materials shall not be brought to the site until they are to be used. Deliver quantities necessary to complete the work shown on the Drawings. Any discrepancy in the quantities given on the plans shall not entitle Contractor to additional remuneration.
 - 2. Deliver Bulk materials to the job site and store to deter mixing with other bulk materials, saturation by rainwater, contamination and/or contact with other deleterious substances or materials.
 - 3. Deliver plants with identification labels.
 - a. Labels should state correct name and size.
 - b. Use durable, water-proof labels with water resistant ink that will remain legible for at least 60 days.
 - 4. Protect plant materials during transport to prevent damage to rootball or desiccation of leaves.
 - 5. Remove unacceptable plant materials immediately from job site.
 - 6. Contractor shall endeavor to coordinate delivery with installation schedule so that plant material is installed on the same day.
- B. Storage:
 - 1. Plants: Maintain plant material in healthy growing condition at all times. Protect plants from drying winds, vandals and animals. Keep plants that cannot be installed immediately in the shade, if shade plants and in the sun, if sun plants. Water and feed as necessary. City's Representative reserves the right to reject plants that decline in quality after delivery to site.
- C. Under no circumstances shall any work be performed if the temperature exceeds 90 degrees or is below 40 degrees. No planting shall be done with the soil saturated with water.

1.13 PROTECTION OF EXISTING PLANTS TO REMAIN

- A. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of any existing plant to remain except as actually required for construction in those areas.
- B. Provide barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.
- C. Notify City's Representative in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing plants to remain.
- D. If existing plants to remain are damaged during construction, Contractor shall replace such plants of the same species and size as those damaged at no cost to Owner. Determination of extent of damage and value of damaged plant shall rest solely with City's Representative.

PART 2 - PRODUCTS

2.01 SOIL AMENDMENTS

- A. The following organic amendments, soil amendments, and fertilizer rates and quantities are to be used for bid basis only. Contractor shall arrange and pay for testing by an accredited soils laboratory of existing site soil after rough grading operations are complete, and shall amend the soils according to said laboratory's recommendations. The soils recommendations shall be considered a part of this specification.
- B. Topsoil: Provide topsoil as required to complete landscape work. Topsoil to be furnished shall be fertile and friable, possessing characteristics of representative productive soils on the site. It shall not contain toxic substances which may be harmful to plant growth. If herbicide contamination is suspected then a radish/rye grass growth trial must be performed. Consult with City's Representative prior to decision to test. It shall be uniformly textured and free of all objectionable foreign materials, oil, or chemicals which may be injurious to plant growth. Natural topsoil shall possess a pH factor between 5.5 and 7.5, a sodium adsorption ratio (SAR) of less than 8, a boron concentration of the saturation extract of less than 1 ppm, and salinity of the saturation extract at 25 degrees C. of less than 4.0 millimhos per centimeter.

Obtain topsoil from naturally well- drained sites where topsoil occurs in a depth of not less than 4 inches; do not obtain from bogs or marshes. Topsoil from the project stockpile which meets the requirements is acceptable.

- C. Imported Topsoil:
 - 1. Import topsoil as needed to complete the job with the following properties:
 - a. Fertile, friable, natural, productive, even textured soil containing a normal amount of humus, capable of sustaining healthy plant life, free of subsoil, heavy or stiff clay, rocks, gravel, brush, roots, weeds, noxious seeds, sticks, trash or other harmful substances, with no nematodes or other noxious animal life or toxic substances. Obtain soil from well-drained, arable land, where no noxious weeds such as Morning Glory, Sorrel, or Bermuda Grass are growing. "Sandy Loam" or "Loam" as classified in accordance with USDA Standards.

- b. Imported planting soil pH value to be between 6.0 and 7.5 with boron concentration of the saturation extract of less than 1 ppm, salinity of the saturation extract at 25 degrees C. of less than 4.0 millimoles, and a sodium absorption rate (SAR) of less than 8.
- c. Silt and clay content of imported planting soil is not to exceed that of the existing soil it is to be placed over.
- d. Do not deliver topsoil to the site until City's Representative has reviewed soils report and has approved submittals by City's Representative.

D. Imported Soil Fill

- 1. Import soil fill as needed to complete the job with the following properties:
 - a. Imported planting soil pH value to be between 6.0 and 7.5 with boron concentration of the saturation extract of less than 1 ppm, salinity of the saturation extract at 25 degrees C. of less than 4.0 millimoles, and a sodium absorption rate (SAR) of less than 8.
 - b. Silt and clay content of imported planting soil is not to exceed that of the existing soil it is to be placed over.
 - c. Do not deliver topsoil to the site until City's Representative has reviewed soils report and has approved submittals by City's Representative.

E. Organic Amendment:

- 1. For bidding purposes, assume Soil Amender Compost, available from Organic Solutions, ph. 707-751-0466 or approved equal. Application rate per 1000 square feet:

6 cubic yards	Organic Compost
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- 2. Organic Amendment: Feedstock shall be no longer recognizable. Compost amendment shall contain fairly uniform particle size, no weed sprouts. Submit a nutrient analysis and testing data from a third party or soil lab, such as the STA Seal of Testing Assurance by the US Composting Council; or OMRI, Organic Materials Review Institute. Organic Compost shall meet the following criteria:
 - a. Particle size: 100% passing a 1" screen or smaller.
 - b. Salt Concentration: Must be reported; may vary but < 4.0 mmhos/cm preferred. Soil should be test. <2.5 mmhos/cm preferred for soil/compost blend.
 - c. Feedstock Materials shall be specified and include at one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
 - d. Nutrient Content: provide analysis detailing nutrient content including N-P-K; Ca; Mg; S; and Bo. Nitrogen content 1% or above preferred.
 - e. Trace Contaminants Metals (Lead, Mercury, etc.). Product must meet US EPA, 40 CFR 503 regulations.
 - f. pH: pH shall be between 5.5 and 8.
 - g. Visible Contaminants: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 0.1 % by weight or volume.
 - h. Moisture Content shall be between 35% - 55% of dry solids.
 - i. Organic Matter Content: 50% - 60% by dry wt. preferred, 30-70% acceptable.
 - j. Carbon and Nitrogen Ratio: C:N < 20:1.

- k. Stability/Maturity: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
- l. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

F. Fertilizer:

- 1. Turf and groundcover areas:
 - a. 6N-20P-20K, 25 lbs. per 1,000 square feet or 6N-24P-24P, 15 lbs per 1,000 square feet.
 - b. Starting one month after planting, on a monthly basis until start of Maintenance Period, apply 12N-8P-16K fertilizer. 7 lbs. per 1,000 square feet.
- 2. Shrubs and trees:
 - a. 21 gram tablet 20N-10P-5K slow release fertilizer tablets as manufactured by Agriform or approved equal. Apply according to Manufacturer's instructions and as follows:
 - 1) 36" Box shall receive 36 tablets
 - 2) 24" Box shall receive 24 tablets
 - 3) 15 Gallon shall receive 10 tablets
 - 4) 5 Gallon shall receive 3 tablets
 - 5) 1&2 Gallon shall receive 2 tablets
 - b. Starting one month after planting, on a monthly basis until start of maintenance Period, apply 12N-8P-16K fertilizer 7 lbs. per 1,000 square feet.

2.02 TOP MULCH

- A. Recycled Pro-Chip Decorative Mulch, dark brown Available from Earth Tones Mulch, 1-800-536-6702, or approved equal.

2.03 GROUNDCOVERS, TREES, AND SHRUBS

- A. All plant materials shall be nursery grown in accordance with the best known horticulture practices and under climatic conditions similar to those in the locality of the project. Container stock shall have grown in the containers in which delivered for at least six (6) months, but not over two years. No container plants that have cracked or broken balls of earth when taken from container shall be planted except upon special approval by City's Representative.
- B. Roots to be healthy and extend to the bottoms and sides the container with no signs of restriction due to kinked, circular or distorted growth or deformed or circling roots at the liner stage. Rooting to be extensive enough to hold the rootball together during planting, but not as dense as to discourage root establishment into surrounding soils. No plants with roots that have encircled themselves will be accepted. In case of any unsatisfactory root system, a total group of plants may be rejected.
- C. Plants shall be vigorous and shall have a normal habit of growth. Plants shall be free of damage by insects, pests, diseases or wind; burns from insecticides or fertilizer; and stunted growth due

to lack of water, lack of food, diseases, or other causes. Plants shall be in conformity with the sizes shown on the drawings.

- D. Trees: Unless otherwise specified, tree trunks shall be straight with leader intact, undamaged, and uncut. All old abrasions and cuts are acceptable only if completely callused over.
- E. Quantities: Quantities necessary to complete the work as shown on the drawings shall be furnished.

2.04 TURF SOD

- A. Sod shall be one year old and dense with grass, having been mowed at 1 in. height before lifting from field. All grown on fumigated soil. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects.
 - 1. Sod shall be grown of seed mix of the following proportions by weight:
 - a. Dwarf Tall Fescue:
 - 80% Bonsai
 - 20% Pixie

2.05 TREE SUPPORT POLES

- A. Peeled, lodge pole pine logs, treated with Chemonite or ACQ or approved equal, clean, smooth, new, and sized as follows:
 - 1. Three inch (3") diameter by ten (10') long for trees greater than 8 feet high and 1 inch caliper.

2.06 TREE TIES

- A. Flexible strap, 24 inch minimum length without sharp edges adjacent to trunk, V.I.T. cinch-ti, or approved equal.

2.07 WATER SOURCE

- A. Water source shall be provided by Owner. Contractor shall provide transport as required.

2.08 ROOT CONTROL BARRIERS

- A. Root barrier CP 24-2, min. thickness .080", Century Products (714) 632-7083. Root barrier shall be used on all trees 6' or closer to pavement, utilities, curbs, etc. Or approved equal. See detail.

2.09 FILTER FABRIC

- A. Filter Fabric: Polyester non-woven filter fabric with uniform fiber distribution by "Terra Bond" #1115, "Mirafi, Inc." #140NS, or approved equal.

2.10 PRE-EMERGENCE WEED KILLER

- A. Clean non-staining as recommended by a licensed pest control specialist and as approved by City's Representative in compliance with the City's Representative's Integrated Pest Management Policy.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspections by the Landscape Contractor:
 - 1. Before proceeding with the work: Carefully inspect all areas and verify all dimensions and quantities.
 - 2. In the event of discrepancy, immediately notify the City's Representative. Do not proceed with this installation in areas of discrepancies until all such discrepancies have been fully resolved.
 - 3. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.
 - 4. Inspect trees, shrubs and ground cover plants for injury, insect infestations, and proper pruning.
 - 5. General contractor shall coordinate rough grading of site to ensure the Landscape Contractor shall receive all planting areas graded to ± 0.10 ft. of finish grades shown on the Drawings. Allow for depth of soil amendments and mulch in determining the difference between finished subgrade in groundcover and shrub beds. Verify that subgrades are not compacted. Do not proceed until detrimental conditions are corrected. Contractor shall take precautions during the excavation of all planting areas to not undermine or damage all adjacent pavements, footings and their associated subgrades.

3.02 FIELD QUALITY CONTROL/INSPECTIONS

- A. Progress observations: In addition to the installation observations specified below, the City's Representative may make periodic progress observations.
- B. Installation observations: Request at least 4 working days in advance:
 - 1. Observation of finish grading.
 - 2. Observation of plant material upon delivery to site.
 - 3. Observation of layout and placement of plant material at time of planting.
 - 4. Observation of any planting drainage problems, as identified by Contractor.

The above shall be considered check points and the Contractor shall only proceed with the work after the City's Representative has visited the site and determined that the work is proceeding satisfactorily.

- C. Maintenance Observations: For the purpose of establishing the start of Maintenance Period and observing completion of the Work of this Section through Final Acceptance. Request at least 7 working days in advance:
 - 1. Observation for Maintenance Period commencement.
 - 2. Observation for Final Acceptance.

3.03 REVIEW AND ACCEPTANCE OF PLANT MATERIAL

- A. Upon plant delivery, arrange material so that canopies or branch tips are not touching so that City's Representative can review plant material at project site.
- B. Do not install material that has not been reviewed and accepted by City's Representative.
- C. Arrange and pay for permits and inspections required for delivery of plant material.

3.04 FINE GRADING AND SOIL PREPARATION

- A. General Fine Grading and Soil Preparation
 - 1. The Contractor shall prepare the site for landscaping. In the areas designated for landscaping on the plans, he shall inspect planting areas and remove all base rock and other foreign material.
 - 2. Rip in two directions all planting areas full depth of compacted fill (to a minimum of 12 inches) into undisturbed native soil prior to backfilling. Uniformly distribute and spread planting soil backfill in planting areas in layers not to exceed 18" and compact to a maximum of 85% relative compaction.
 - 3. When the planting soil differs in clay and silt content from the subsoil it is to be placed upon, install a 4-inch thick lift of planting soil on the subgrade and rototill into the subgrade 6 inches deep before installing the remaining required planting soil.
 - 4. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.
 - 5. Water settling, puddling, and jetting of fill and backfill materials, as a compaction method is not acceptable.
 - 6. Maintain moisture content of materials during compaction operations within required moisture range to obtain indicated compaction density.
- B. The Contractor shall alleviate compacted soils before planting, for all landscaped areas that cannot be protected during construction.
 - 1. Scarification: Scarify all planting areas prior to fine grading in order to ensure relative compaction of 85% or less. Any planting areas which become compacted in excess of 85% due to construction activities shall be thoroughly cross-ripped to the maximum depth feasible to alleviate that condition, taking care to avoid all existing drainage and subsurface utility lines. See plans.
 - 2. Scarification of any planting area that cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the City's Representative to the specified depth to ensure proper drainage.

- C. Drag to a smooth, even surface. Grade to form all swales, pitch to catch basins, streets, curb, etc. to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly level or sloped between finish elevations. Provide surface drainage of planted area. Correct drainage conditions that may be detrimental to the growth of plant material or which will result in excessive retention of water in tree pits. Minimum slope in landscape areas shall be two percent (2%) or as shown on drawings. Slope away from building.
- D. Cultivation and Placement of Amendment:
1. Hold finish grade and/or mulch surface in planting areas 1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc.
 2. Spread soil amendment, fertilizers and other additives evenly over installed and rough graded topsoil in all planting areas including turf, ground cover and shrub areas at the rates specified in the soils analysis report. For bid basis, use the following rates (Do not apply fertilizer to areas to be hydroseeded):
 3. In areas to be planted with shrubs cultivate to a depth of 18". In turf and groundcover areas, cultivate soil to a depth of 8". Incorporate 6 cubic yards per 1000 square feet of organic amendment. Prior to planting incorporate to a depth of 6" the following fertilizers, per 1000 square feet:
 - a. 6N-20P-20K at 25 lbs/1000 sq. ft. or 6N-24P-24K at 15 lbs/1000 sq. ft.
 - a. Iron Sulfate: 2.5 lbs. per 1,000 square feet.
 - b. Soil Sulfur: 15 lbs per 1,000 square feet.
 - c. Agricultural Gypsum: 25 lbs per 1000 square feet
 4. Areas within the driplines of existing trees shall be hand cultivated.
- E. Finish Preparation in Turf Areas:
1. Roll to compact amended soil to not more than 85% compaction. Finish grade shall be 1" below adjacent paving, curbs, or walls unless otherwise shown on drawings. Finish out smoothing, even surfacing conforming to established grades after settlement. Rake immediately prior to planting.
 2. If rain is likely between completion of soil preparation and planting, precautions shall be taken to prevent erosion of the soil.
- F. Soil Mix for Backfill of Shrubs, Trees and Ground Covers: The following ingredients shall be tumbled to achieve a homogeneous mix:
1. Organic amendment 1 cubic yard
 2. Topsoil 3 cubic yards
- G. Contractor to remove any lime treated soil from planting areas and over excavate for drainage prior to the placement of top soil and import soil backfill.
- H. Soil Mix for Backfill of Pots: The following ingredients shall be tumbled to achieve a homogeneous mix:
1. Organic amendment 1 cubic yard
 2. Topsoil 3 cubic yards
- Top dress each pot with one pound of Osmacost 17-7-12 fertilizer.

3.05 HANDLING OF PLANTS

- A. Prevent damage to plant material. Lift and handle plants only from bottom of rootball.
- B. Do not plant material that has not been reviewed by City’s Representative upon delivery to the project site, or that has been rejected for any reason. Do not plant under unfavorable weather conditions.
- C. The Contractor shall protect all utilities, vegetation, and structures during work.
- D. Trees shall be located a minimum of 3' from walls, overheads, walks, headers, and other trees within the project. If conflicts arise between size of areas and plans, Contractor shall contact City’s Representative for resolution. Failure to make such conflicts known to the City’s Representative will result in Contractor's liability to relocate the materials.

3.06 SHRUBS AND TREES

- A. Preparation:
 - 1. City’s Representative will review, for conformance to design intent, locations of all plants in the field prior to planting. Notify City’s Representative and schedule layout review sufficiently in advance of planting to allow for review and adjustment without disrupting construction schedule.
 - 2. Stake layout of trees in field before installing irrigation. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the City’s Representative before plant holes are dug. Adjust as necessary prior to planting. City’s Representative reserves the right to make minor adjustments in the layout of all plant material; adjust irrigation system as necessary.

- B. Excavation:
 - 1. Excavate container grown tree, shrub, groundcovers and vine pits as follows. If rocks, underground construction work, tree roots or other unknown obstructions are encountered in the excavation of plant holes; City’s Representative may select alternate locations. Report all such conditions in writing to the City’s Representative. Where locations cannot be changed, submit a written proposal and cost estimate for removing the obstructions to a depth of not less than 6 inches below the required hole's depth. Obtain City’s Representative's instructions prior to proceeding with the work affected.

<u>Excavation for</u>	<u>Width</u>	<u>Depth</u>
Boxed Trees	Box + 24"	Box + 12"
Canned Trees/Shrubs (15 gal) or larger	Can + 24"	Can + 12"
Canned Shrubs/Vines (2.5 to 5 gal)	Can + 18"	Can + 8"
Canned Shrubs/Groundcover/Vines (1 gal)	Can + 12"	Can + 6"

All plant pits shall be dug with vertical walls. The sides and bottoms of all planting pits shall be thoroughly scarified to ensure root penetration.

- C. Percolation Testing:
 - 1. Contractor shall verify water drainage of all planting pits with a percolation test prior to planting.

2. Fill full sized planting pit with water and observe in 24 hours.
3. Notify City's Representative if planting pit has not fully drained before proceeding with the planting operation for all areas not draining, and all soil conditions considered detrimental to growth of plant material. State condition, and proposal and cost estimate for correcting the condition.
4. Obtain City's Representative's instructions prior to proceeding with work affected.
5. Repeat drainage testing and correction of conditions until tests are passed.
6. Failure to perform drainage tests, or to notify City's Representative in writing of conditions specified above, renders Contractor responsible for all plant failure that occurs as a result of inadequate drainage or detrimental soil conditions, as determined by City's Representative.

D. Plants in Containers:

1. Plants shall be removed carefully from their containers after the containers have been cut on two sides minimum; fifteen-gallon containers shall be opened in three places. In the case of boxed plant specimens, the wood shall be removed at the sides and at the bottom of the box.
2. After removing plant material from its container, stimulate root growth by making four or five vertical cuts 1" deep around the circumference of the root ball.
3. Do not lift or handle plants by the top, stems, or trunk at any time. All plants shall be lifted in such a manner that the root ball is supported from the underside.
4. The Contractor shall check all plants for adequate root systems. If the root system is defective, he shall remove deficient plants from the site and replace them with new ones.

E. Planting:

1. Carefully remove and set plants and trees without damaging the rootball. Do not install plants or trees with damaged rootballs. Cutting or scoring of rootballs to be done only if species is known to be tolerant of such treatment. Superficially cut tolerant plants' edge roots vertically on three sides using a knife.
2. For trees remove sides of boxes after positioning the plant and partially backfilling.
3. Center plant in pit or trench over tamped mound.
4. Face for best effect.
5. Set plant plumb and hold rigidly in position.
6. All plants shall be set in the ground so that the root ball will be flush with the finish grade. All plants that settle below the finish grade within 30 days of acceptance of the work shall be replanted in the proper position. In case a total section of planting area settles, the Contractor shall lift the plants, import additional soil mix, regrade, and replant, at no additional cost to the Owner.
7. Back fill:
 - a. Backfill plant holes with soil mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement.
 - b. Set plants in backfill with top of the rootball 2 inches above finished grade. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole. Thoroughly water all plants immediately after planting, eliminating air pockets. Prevent erosion.

- c. The filled pit shall be flush with surrounding grade when complete.
- 8. When the plant pit has been approximately one half filled, place planting tablets according to the manufacturer's schedule and per Section 2.01 Subsection K Fertilizer, paragraph 2.
- 9. Build 6" high watering basin berms around trees and shrubs to drain through rootball. Basins are not required around trees in turf areas.
- 10. Apply post-planting fertilizer.
- 11. Planting operation for plants in raised concrete planters is same as above except that finish grade of soil mix shall be 1 1/2" below top of planter walls. Planters may be backfilled with excess topsoil up to the depth specified for plant pits above which backfill shall be soil mix.
- 12. Planting operations for plants in precast planters is the same as stated in paragraph 11 above. Fill entire planter with soil mix. Place planters as shown on planting plans.

3.07 GROUND COVER AREAS

A. Planting:

- 1. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.
- 2. Space plants equally and uniformly at spacing indicated on the Drawings, which are the maximum and in a triangular pattern.
- 3. Plant pits shall be sufficiently large so that the root can be freely suspended in the pit. After backfilling the pit, firm the soil so that there will be no air space around the roots.
- 4. Apply post-planting fertilizer.
- 5. Mulch all ground cover areas with 3" layer of mulch.

3.08 TURF SOD

A. Inspection:

- 1. Upon the completion of the placing of the soil and prior to placing sod, the Contractor shall call for an inspection of the turf irrigation system. The sod shall be placed after the Owner's Representative has satisfied himself that the irrigation system is operating satisfactorily and finish grade is in accord with the Drawings.

B. Laying Sod:

- 1. Remove all rubble, sticks, rocks and stones 1" or larger from top 2" amended soil.
- 2. Arrange for delivery of sod in the morning to insure same-day installation.
- 3. Lightly roll surface and re-shape to level humps and hollows. Secure Owner's Representative's approval prior to sodding. Do not sod on dry soil.
- 4. Lay first strip of sod along a straight line (use a string in irregular areas). Butt joints tightly, do not overlap edges. On second strip, stagger joints. Use a sharp knife to cut sod to fit curves, edges and sprinkler heads.
- 5. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to sod and to water until installation is complete. Lay sod without stretching. Stagger end

seams and butt edges as close as possible to each other. Roll with sod roller perpendicular to direction it was laid.

6. After laying all sod, roll lightly to eliminate irregularities and to form good contact between sod and soil. Avoid a heavy roller and excessive initial watering.
7. Thoroughly water the completed sod surface to at least 8 inches deep. Repeat sprinkling at regular intervals to keep sod moist at all times until rooted. After sod is established, decrease frequency and increase amount of water per application.
8. Protect turf areas by erecting fences, barriers and signs necessary to prevent trespass. Keep barriers neat and well maintained.
9. Apply post-planting fertilizer.

C. At the time of final inspection the turfs shall be dense, green, and weed free. It is the Contractor's responsibility to eliminate any bare spots, dead areas and weeds.

3.09 TOP MULCH

- A. Except where rock mulch is required, mulch all shrub and ground cover areas with organic mulch to a 3 inch depth. Mulch ring at trees in turf areas to be 3 foot diameter for up to 36 inch box. Do not pile mulch around crowns of plants. Keep root crown free of mulch.

3.10 TREE STAKING

- A. Stake trees as indicated on the Drawings. Drive stake until solid and remove excess stake protruding above top tree tie to prevent rubbing against branches. Allow 1 to 3 inches sway in trunk or branches; do not pull tight.
- B. Tying: Find the proper support height by holding the trunk in one hand and pulling the top to one side and releasing it. The lowest height, at which the trunk will return to the upright position when the top is released, is the height at which to attach tree ties.

3.11 ROOT GUARD

- A. Install as detailed and as specified below. If not shown, install in accordance with manufacturer's recommendations. Excavate an additional 12 inches below the proposed bottom edge of tree root barrier, then compact this space with the original excavation materials. Install the panels so that the vertical root deflecting ribs on the panels face inward, toward the root ball. The double top edge of the barrier should be positioned flush with finished grade. Install root barrier as indicated and at locations on drawings.
- B. Install root control barrier for all trees located within 5 feet-0 inches of paved areas, in accordance with manufacturer's recommendations.
- C. Root Barrier shall be installed in a linear fashion and shall never circle a tree.

3.12 PRUNING

- A. Tree and Shrub: Pruning shall be performed as required to maintain a natural appearance, promote healthy and vigorous growth, and eliminate diseased or damaged growth.

- B. Trees shall be pruned to thin crown and avoid wind damage, eliminate narrow V-shaped branch forks that lack strength, eliminate sucker growth, and maintain a radial branching pattern to avoid crossing branches.
- C. Under no circumstances will stripping of lower branches ("raising-up") of young trees be permitted. Lower branches shall be retained in a "tipped back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).
- D. Major pruning of trees to compensate for root loss or for aesthetic reasons shall be done only with approval of the City's Representative.
- E. Shrubs shall not be clipped into balled or boxed forms, unless such is required by the design and directed by the City's Representative.
- F. All pruning shall be made flush to lateral branches, buds, or trunk. "Stubbing" will not be permitted.
- G. Damage: All cuts over 1" resulting from pruning or wind breakage shall be inspected periodically for insect infestation or disease.

3.13 WATERING

- A. Water all trees, shrubs and ground cover immediately after planting. Apply water to all plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Do supplemental hand watering of trees and shrubs during the first 3 weeks of plant establishment as necessary.

3.14 CLEAN UP

- A. Keep all areas of work clean and neat at all times. Upon completion of planting, all cans, boxes, and other debris that is a part of the planting operation shall be removed from the site.
- B. All pavements shall be washed off, and site shall be left in an absolutely clean condition. All planting areas shall be cultivated and weed free before final inspection. Clean-up operations shall take place throughout the course of work so that walks and drives are clean at all time.

3.15 PRE-MAINTENANCE/PLANT ESTABLISHMENT PERIOD REVIEW AND APPROVAL OF PLANTING

- A. Notify the City's Representative a minimum of five (5) days prior to requested Punch List and for Final Acceptance Review. Before the reviews, complete the following:
 1. Complete all work per Specifications and Plans.
 2. Present all planted areas neat and clean with all weeds removed and all plants installed and appearing healthy.
 3. Plumb all tree stakes.
 4. Seed or hydroseed all areas per plans.
 5. Turf sod all areas per plans.
 6. Settlement: Reset plants that have shift or settled.

- B. Punchlist Inspection:
 - 1. At this time the Contractor shall have completed all phases of the Plans and Specifications for planting and irrigation. Any discrepancies shall be noted at that time and the Contractor shall make appropriate corrections before the Final Acceptance of the work and the beginning of Maintenance Period is established.
 - 2. No partial approvals will be given.
- C. Final Acceptance
 - 1. Should it be determined at the Final Acceptance visit that any punchlist item is incomplete, any further review of the site will be terminated until all items are guaranteed, in writing, to be complete by the Contractor. The cost of additional site visits by the City's Representative to verify completion of work shall be paid for by the Contractor.

3.16 PLANT ESTABLISHMENT MAINTENANCE PERIOD

- A. The planting establishment maintenance period required shall be 90 calendar days after all planting is complete, turf is seeded, and installation approved.
- B. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are complete. Project will not be segmented into maintenance phases, unless specifically authorized in writing by the City's authorized representative.
- C. A longer plant establishment – maintenance period may be required if the turf is not thick, vigorous and even, or if the plant material is not acceptably maintained during the maintenance period. The maintenance period may be suspended at any time upon written notice to the Contractor that the landscaping is not being acceptably maintained, and the day count suspended until the landscape is brought up to acceptable standards as determined by the City's Representative.
- D. Contractor shall furnish all labor, material, equipment, and services required to maintain the landscape in a healthy and attractive condition for a period of 90 days.
- E. Maintenance shall include fertilization, watering, insect and disease control, weed control, weekly trash removal, mulching, restaking trees, tightening of guys, resetting plants to proper grades or upright position, and restoration of watering basins.
- F. Maintenance of grass areas shall consist of fertilizing, watering, weeding, mowing, repair of all erosion, and reseeding as necessary to establish a uniform stand of the specified grasses. Areas and parts of areas which fail to show a uniform stand of grass for any reason shall be (reseeded or) resodded until all areas are covered with a satisfactory stand of grass. (Mulch reseeded areas with 1/4 in. of specified peat moss).
- G. The Contractor's maintenance period will be extended if the provisions required within the plans and specifications are not filled.
- H. General Requirements:
 - 1. Keep all walks and paved areas clean. Keep the site clear of debris resulting from landscape work or maintenance.

2. Repair all damaged planted areas, and replace plants and reseed or resod grass immediately upon discovery of damage or loss.
3. Check sprinkler system at each watering; adjust coverage and clean heads immediately. Adjust timing of sprinkler controller to prevent flooding.
4. Keep Contract area free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds over 1-inch high at all times.
5. Settlement: Reset plants that shift or settle before end of maintenance period. Crowns of trees shall be at the following minimum height above surrounding finish grade at end of maintenance period: 24 inch box and smaller - 2 inches.
6. Protect all areas against damage, including erosion and trespass, and provide proper safeguards. Maintain and keep all temporary barriers erected to prevent trespass.

I. Tree, Shrub and Ground Cover Maintenance:

1. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the City's Representative.
2. Keep watering basins in good condition and weed-free at all times.
3. Replace all damaged, unhealthy or dead trees, shrubs, vines and ground covers with new stock immediately, size as indicated on the drawings.

J. Turf:

1. Maintain during the entire establishment period. Cut as frequently as growth of grass requires. Cut to a height of two inches (2"), unless otherwise directed by the City's Representative.
2. Maintain appropriate soil moisture at all times for healthy and vigorous turf grass.
3. Trim edges of turf at paving and header boards at time of second cutting, and at each later cutting.
4. Keep the designated area under trees free of turf at all times. Do not create low area around base of tree.
5. Keep turf areas free of undesirable weeds and grasses by the application of suitable selective weed killers or hand pulling.
6. Reseed all damaged areas as soon as evident.
7. Repair any hollow, settled or eroded areas by filling, rolling and resodding.

K. Watering:

1. All plants shall be kept watered as often as it is necessary to keep them in optimum, vigorous growth. The turf shall, at no time, show a lack of fresh green color or a loss of resilience due to lack of water. Watering shall be done preferably during the early morning hours.
2. Water shall be controlled so that there will be no excessive run-off, ponding, or overwatering.

L. Root Growth: Periodically the Contractor shall check the progress of the root growth within the back fill area. As the root growth increases beyond the root ball, the frequency of watering shall be reduced so that the roots are encouraged to grow to a lower soil depth. Watering then shall be

less frequent, but applications shall be very slow and the Contractor shall assure himself that water does penetrate to the depth of the former plant pit.

M. Weed Control:

1. Weeds shall be kept under control, either by hand or by the application of herbicides designed for use on any type of weeds invading the planting areas.
2. All equipment used for herbicides shall be properly cleaned before it is used on this project. Herbicides shall be applied at temperatures recommended by the manufacturers. Herbicides shall not be used during windy or gusty days. All possible precautions shall be taken to protect vegetation which is susceptible to damage from the particular herbicides to be used.
3. The bases of all plants shall be kept completely free of weeds. Periodically, the base of the trees and shrubs shall be cultivated in order to allow better penetration of water, but such cultivation shall be carefully done in order not to destroy surface roots.

N. Mowing:

1. All mowing shall be done in a neat and orderly manner. Equipment shall be moved onto and off the area to be mowed in such a manner that it will not leave tracks or marks that detract from the finish turf. Timber shall be provided to move equipment over curbs, stairs, or similar constructions.
2. Mowing equipment shall be kept in optimum operating condition. The equipment shall be washed before initial use on the project so that there will be no chance of introducing foreign seeds or diseases onto the project.
3. Frequency of mowing shall be determined by the rate of growth of the grass. During seasons of peak growth mowing may have to be done every five days to six days; under normal conditions once a week should be adequate.
4. The average mowing height shall be 1-1/2". The grass blades must be cut sharply and cleanly. The turf must be cut evenly so that no ridges remain in the finish cut. The direction of mowing shall be alternated each time.

O. Spraying:

1. All shrubs and trees shall be inspected at least twice a month during the growing period to determine the need for spraying to control insect damage, fungus development or any other disease that might be attacking the plants. Preventative spraying shall be done only with the approval of the City's Representative.
2. Operators of spray equipment shall take all reasonable precautions to protect themselves, other people and buildings from spray. The Contractor shall have all permits and licenses required for such an operation. Where applicable, dormant spray shall be applied to shrubs and trees during the winter period.
3. All equipment shall be properly washed before and after use.
4. No spraying shall take place during windy or gusty days.

P. Staking and Guying: Stakes and guys shall be inspected a minimum of two times a month to assure that the wires and ties are tight and no damage has occurred to the tree trunk or branches.

Q. Fertilizing:

1. Upon approval and after submitting fertilizer delivery tags, top dress all turf and ground cover areas by broad-casting 12-8-16 fertilizer at the rate of 7 lbs. per 1,000 square feet evenly throughout, and reapply every forty-five (45) days until acceptable or as appropriate to prevailing climatic conditions and type of plant or turf grass.
2. Apply ammonium sulfate fertilizer as necessary to maintain vigorous, green grass between fertilizing mentioned above.

R. Litter:

1. The Contractor shall remove promptly after pruning, trimming, and weeding or other work required under the contract, all debris generated by his performance of the work. Immediately after working in the areas of public walks, driveways or paved areas, they shall be vacuumed clean with suitable equipment. All areas covered by this contract shall be kept free of the following items: bottles, cans, paper cardboard or metallic items. Common debris and litter shall be disposed of in an appropriate manner.

S. Pruning:

1. Prune as necessary to remove injured twigs and branches, dead wood, and suckers.

3.17 FINAL PLANTING REVIEW AND WRITTEN ACCEPTANCE (TURN OVER ACCEPTANCE)

- A. Final Review: At the conclusion of the planting establishment period, schedule a final review for Final Written Acceptance/Turn Over Acceptance. The conference shall include the Owner. Any discrepancies shall be noted at that time and the Contractor shall make appropriate corrections before the Final Written Acceptance of the work and the beginning of Guarantee Period is established.
- B. Final Written Acceptance/Turn Over Inspection: A conference including the Owner shall be held at the completion of all project improvements and all corrective work. The Contractor shall continue to maintain the project at his own expense until all deficiencies have been corrected. Once completed, the Contractor shall request the City's Representative and Owner to visit the site and approve the project as complete. The City's Representative will accept the landscape project in writing. The date of the Final Written Acceptance letter shall be the first day of the guarantee period.
- C. Prior to either review, weed and rake all planted areas, repair plant basins, mow and edge turf, plumb tree stakes, clear the site of all debris and present in a neat, orderly manner.
- D. Submit written notice requesting review at least 5 days before the anticipated review.

3.18 GUARANTEE AND REPLACEMENT

- A. Guarantee period shall be extended for a period of one year from the date of Final Written Acceptance.
- B. All plants shall be guaranteed to be alive and healthy as determined by the City's Representative at the end of the guarantee period.

- C. Plant materials supplied by Owner shall be under similar warranty against defective workmanship during the planting operations. Plant material exhibiting conditions which are determined by the City's Representative as being unacceptable, due to workmanship by the Contractor, shall be replaced at no additional cost to the Owner.
- D. The Contractor shall replace, in accordance with the Drawings and Specifications throughout the guarantee period, any plants that die, or in opinion of the City's Representative, are in an unhealthy or unsightly condition, and or have lost their natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or any other causes due to the Contractor's negligence. The Contractor shall not be held responsible for acts of vandalism occurring after the beginning of the guarantee period.

END OF SECTION 32 90 00

SECTION 32 93 43
PALM TREE PLANTING

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and place palm trees and all related work including but not limited to all labor, materials, excavations, import soil, rentals, cranes, fertilizer, organic materials, drainage, drain connections, warranty, all labor and incidentals required to provide and/or transplant palm trees.
- B. Related Work:
 - 1. Section 32 84 00 - Irrigation System
 - 2. Section 32 90 00 - Landscape Planting

1.02 INSPECTIONS

- A. All inspections which may be required by the State of California and/or City of Santa Rosa for plant materials moved within California are the sole responsibility of the landscape contractor. Contractor shall notify all appropriate parties upon delivery of palms to the work site, and shall secure all necessary permits which may be required.
- B. Palms shall be subject to inspection and approval at the place of growth prior to shipment and/or at the project site upon arrival from the place of growth by the Landscape Architect or their designated representative.
- C. A written notice shall be submitted to the owner indicating date and time of delivery a minimum of 7 days prior to delivery.

1.03 SUBMITTALS

- A. Furnish 6 copies of manufacturers' literature for the following items:
 - 1. Fertilizer
 - 2. Fertilizer tablets
 - 3. Palm tree import soil backfill
 - 4. Palm tree photographs (prior to digging, skinned, prior to delivery and upon arrival of each palm tree). Provide reference scale for each photograph.
 - 5. 12 Month Palm tree warranty
 - 6. Root ball guy kit

PART 2 - PRODUCTS

2.01 PALM TREE MATERIAL

- A. All palms shall be purchased from a single nursery appropriately licensed to sell and transport nursery stock in California.
- B. Designated palms shall be true to form, name and matching in size, straight, height, diameter, shape, and pruning.
- C. Palms shall be field grown and shall come directly from a single source established field growing grounds. Palms which have been previously dug, shipped, or previously stored in any manner are not acceptable under the terms of this specification.
- D. Minimum height shall be 14' feet (BTH), not including fronds, head, and root ball.
- E. Foliage shall be well developed, healthy, and free from disfigurements and cosmetic injuries.
- F. All foliage and head area shall be sprayed following pruning and prior to shipping with a preventative fungicide to inhibit the establishment and spread of Fusarium and Penicillium diseases. Nursery shall verify and certify that palms have been inspected and are certified disease free.
- G. Trunks shall be free from all defects including decay, abrasions, climbing spike holes, sun scald, disease and pests, or any objectionable disfigurements.
- H. Trunks shall be cleared from ground level to the bottom of shipping fronds, shall be single trunked and straight, shall not have basal suckers, and shall be uniform in diameter from ground level to head. Significant variation of trunk diameter beyond normal taper on individual palms shall be grounds for rejection.
- I. Air root shall be similar between all trees within a grouping.
- J. Root ball shall be intact with a minimum 36" diameter and a minimum 60" depth. Dead or damaged roots should be removed from rootball, avoiding damage to any living portion of the tree or rootball.
- K. Root systems shall be vigorous and well developed and shall not show signs of root disease or root pests.
- L. Photos for each palm shall be submitted for review and approval at the time of acquisition by the contractor and again prior to delivery.

2.02 ACCESSORIES

- A. Root ball anchor system
 - 1. Mfr: Oasis Tree Care
 - Model: Root Ball Earth Auger System w/ 3" webbing and ratchets, galvanized w/ #138 earth

anchors.

2.03 DIGGING REQUIREMENTS

- A. Palms may be excavated by hand or by machinery as long as root mass remains intact, and minimum root ball diameter and width are maintained.
- B. Field soil shall be thoroughly soaked prior to excavation and root balls shall be maintained in a uniformly moist condition at all times during handling and shipping.
- C. Burlapping of root balls to prevent root desiccation is required during transportation of palms being moved by open trailer, more than 300 miles.
- D. No more than 72 hours shall elapse from the time palms are excavated to the time they are delivered to the job site.

2.04 PRUNING PROCEDURES

- A. All palms require fronds to be removed prior to transporting to appropriately balance the loss of roots expected during excavation. A minimum number of fronds shall be removed to achieve this balance while at the same time appropriately protecting the apical growing bud of the palm. Do not cup off top of any remaining fronds.
- B. All palms shall be skinned uniformly prior to shipment to the job site.
- C. All palm fronds shall be tied in an upright position with untreated 2 ply twine which shall be tied horizontally across the palm fronds tightly enough to remain during transportation and installation. Fronds shall remain tied during installation procedures and shall be allowed to open after 30 days as twine deteriorates.
- D. These pruning procedures shall be mutually agreed upon by the Landscape Architect and the palm producer prior to digging.

2.05 DELIVERY, STORAGE AND HANDLING

- A. Loading and Handling of Palms:
 - 1. All palms shall be loaded and unloaded with mechanical or hydraulic cranes. Tractors, front end loaders, or forklifts shall not be used and all rigging and support shall come from nylon slings of a type which will not abrade, bruise, cut, or otherwise damage the palm trunk surface.
 - 2. When rigging is to come into contact with the palm trunk surface or head area, 2" x 6" lumber shall be placed between rigging and trunk surface. Boards shall be situated between rigging and palm trunk to prevent abrasions, cuts, or damage which may result from loading and unloading work.
 - 3. It remains the sole responsibility of the landscape contractor and his subcontractors to handle palms in a safe and consistent manner with these specifications. Damage during shipping, storage, handling, or installation of palms remains the sole responsibility of the contractor, and may become grounds for rejection if specifications are not followed.

- B. Transportation of Palms
 - 1. All palms shall be completely tarped with shade or saran cloth which provides 70% or better shade protection. Cloth shall be attached to provide thorough wind protection of both head and root ball.
 - 2. Stacking of palms on truck trailers is an acceptable practice; however, Landscape Architect reserves the right to reject any and all palms which are damaged in any way during transportation whether damage is caused by desiccation, wind burn, or mechanical damage from improper loading or shifting during transportation. The obvious signs of desiccation and wind burn may take several weeks to become visible, and the Landscape Architect reserves the right to reject palms damaged in this manner on a delayed basis.

- C. Handling of Palms at Job Site
 - 1. Palms shall be installed immediately upon arrival at the job site. If delays beyond 24 hours are necessary, all palms shall be 'healed in' at an approved storage facility in a perpendicular position. A 100% washed concrete or plaster sand (no beach sand) backfill shall be provided to completely cover root balls, which shall be thoroughly watered and maintained in a moist condition at all times.
 - 2. All loading and handling procedures shall be repeated as outlined in this specification when handling palms enroute from the storage area to the project site and installation.

PART 3 - EXECUTION

3.01 SITE INSPECTIONS

- A. The contractor shall review all site utilities prior to the excavation of the palm tree pits.
- B. The contractor shall provide all inspections prior to the delivery of palm trees to verify all drainage and irrigation has been installed prior to the placement of the Palm Trees.

3.02 INSTALLATION REQUIREMENTS

- A. Width of planting pits for palm trees shall be a minimum of 84" wide. Depth shall be 2 feet greater than the depth of the root ball and a minimum of 60" deep, or larger in relation to the actual size of the rootball.
- B. Finished grade shall drain a minimum of 2% away from trunk.
- C. Palms shall be planted with trunks at original grade and shall be backfilled entirely with a sand backfill soil which has been analyzed by an approved soil testing laboratory and pre-approved by the Landscape Architect. The sand should be 0.25 - 0.50 mm minimum in particle size (200" per hour infiltration after compaction). This backfill shall be applied in 6" layers, tamped to 85% compaction, and thoroughly settled with water to eliminate air pockets.
- D. Base and sides of planting pit shall be scarified before palm installation to minimize hostile interface and facilitate rooting.
- E. Irrigation shall be installed per tree detail and irrigation plans.

- F. PVC drain lines shall be per tree detail and irrigation and drainage plans.
- G. Trees shall be installed perpendicular to grade and plumbed under the direction of the Landscape Architect.
- H. Install palm tree root ball anchor system per mfr details and specifications.
- I. Any adjustments necessary to straighten palms due to settling or shifting shall be made by the contractor at no charge to the owner within 12 months after final acceptance of the project.
- J. Immediately apply deep irrigation to all palms. After this deep application monitor soil moisture levels and base frequency of irrigation applications on actual evapo-transpiration rates for the site.

3.03 TIMING OF INSTALLATION

- A. Palms shall be installed only during the season of active root growth, corresponding to the period between March 1st and August 31st. Planting at other times of the year greatly encourages the possibility of disease infection and decline.

3.04 MAINTENANCE

- A. The soils surrounding the palms shall be maintained clear of turf or groundcover 2' from the trunk.
- B. Cleared areas shall be maintained weed free.
- C. All weeds shall be hand pulled and the use of herbicides in cleared areas surrounding palms shall not be allowed.
- D. Irrigation water shall not be sprayed directly at palm trunks.
- E. Contractor shall monitor moisture levels around palm trees daily for the first week and then every other week to provide the optimal moisture levels required for growth. Contractor to adjust irrigation and irrigation schedule as required to prevent overwatering.
- F. All palms shall be fertilized in April and August with the following dry fertilizer applied to the soil surface:
 - 1. Par Ex- Palm Tree Special
 - 2. 11-4-6 IBDU/SCU with minors;
 - a. Rate shall be 4 lbs. per single palm uniformly applied in a band application around each cleared trunk area and immediately watered in.
- G. Foliar fertilization shall occur for a period of one year following installation. Installing contractor shall be responsible during the 90 day establishment period and the following 9 month period will be the responsibility of the project owner. On a monthly basis the fronds and heart shall be sprayed with a foliar application of Grace's Minor Gro micro nutrient fertilizer at the recommended label rate. All applications shall be completed through the use of an aerial lift to provide thorough coverage to crown area. Ground application of foliar fertilizers shall not be an acceptable procedure.

- H. Prophylactic fungicide applications shall also occur for a period of one year following installation. Installing contractor shall be responsible during the 90 day establishment period and the following 9 month period will be the responsibility of the project owner. On a monthly basis the fronds and heart shall be sprayed with a foliar application of the fungicides Benlate and Maneb, or suitable substitute. Rate and material to be prescribed in writing by a licensed Pest Control Advisor prior to application. All applications shall be completed through the use of an aerial lift to provide thorough coverage to crown area. Ground application of fungicides shall not be an acceptable procedure.

3.05 WARRANTY

- A. Palms shall be guaranteed by the contractor for 12 months after final acceptance of the project. Contractor liability shall cover palm purchase price, transportation and handling costs, and the cost of labor, equipment, rentals, cranes, protection, traffic control, and materials to replace trees of the same size, quality, and species during the warranty period. All work impacted by replacement including but not limited to mulch, irrigation systems, planting, and hardscape shall be included within the warranty work and fully replaced as required to match the Contract Documents and no cost to the owner.
- B. If disease, physiological stress, or decline of any type occurs during the warranty period contractor shall be responsible for treatment costs and terms of warranty shall remain in place and be extended until vigorous growth returns to the satisfaction of the Landscape Architect.

GUARANTEE FOR PALM PLANTING

WE HEREBY GUARANTEE THAT THE PALM PLANTINGS WE HAVE FURNISHED AND INSTALLED ARE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP, AND THE WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS. WE AGREE TO REPLACE ANY PALMS WHICH ARE IN ANY STATE OF DECLINE, DISEASED, OR HAVE DIED WITHIN THE 12 MONTH WARRANTY PERIOD. WE AGREE TO REPAIR OR REPLACE ANY DEFECTS IN MATERIAL OR WORKMANSHIP, ANY SETTLING OF TREES, WHICH MAY DEVELOP DURING THE PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE AND ALSO TO REPAIR OR REPLACE ANY DAMAGE CAUSED FROM THE REPAIRING OR REPLACING OF SUCH DEFECTS AT NO ADDITIONAL COST TO THE OWNER. ORDINARY WEAR AND TEAR, UNUSUAL ABUSE OR NEGLIGENCE ARE EXCEPTED. WE SHALL MAKE SUCH REPAIRS OR REPLACEMENTS, INCLUDING COMPLETE RESTORATION OF ALL DAMAGED PLANTING, PAVING, OR OTHER IMPROVEMENTS OF ANY KIND, WITHIN A REASONABLE TIME, AS DETERMINED BY THE OWNER, AFTER RECEIPT OF WRITTEN NOTICE. IN THE EVENT OF OUR FAILURE TO MAKE SUCH REPAIRS OR REPLACEMENTS WITHIN A REASONABLE TIME AFTER RECEIPT OF WRITTEN NOTICE FROM THE OWNER, WE AUTHORIZE THE OWNER TO PROCEED TO HAVE SAID REPAIRS OR REPLACEMENTS MADE AT OUR EXPENSE AND WE WILL PAY THE COSTS AND CHARGES THEREFORE UPON DEMAND.

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____

LICENSE NO: _____

ADDRESS: _____

TELEPHONE: _____

GUARANTEE TO: _____

DATE OF ACCEPTANCE: _____

AUTHORIZED REPRESENTATIVE: _____

END OF SECTION

SECTION 33 10 00
WATER UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Site water distribution system for domestic services up to 5 feet of any on-site building being served.

1.02 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfill
- B. Section 32 13 13 – Concrete Paving

1.03 RELATED DOCUMENTS

- A. ASME
 - 1. ASME B1.20.1: Pipe Threads, General Purpose, Inch
- B. ASTM
 - 1. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 2. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
- C. AWWA
 - 1. C800: Underground Service Line Valves and Fittings
 - 2. M23: PVC Pipe – Design and Installation
- D. National Sanitation Foundation (NSF)
 - 1. NSF 61: Drinking Water System Components-Health Effects

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Waterworks Association
- D. FM: Factory Mutual
- E. NSF: National Sanitation Foundation

- F. PCC: Portland cement concrete
- G. PVC: Polyvinyl Chloride
- H. UL: Underwriters Laboratory

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Internal Pressures: As indicated on the Plans.
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Division 1 of the Technical Specifications.
- B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following:
 - 1. Piping materials and fittings
 - 2. Gaskets, couplings, sleeves, and assembly bolts and nuts
 - 3. Restrained pipe fittings
 - 4. Expansion joints
 - 5. Flexible expansion joints
 - 6. High deflection fittings/ball joints
 - 7. Thrust block concrete mix
 - 8. Identification materials and devices
- C. Shop drawings: Include plans, elevations, details and attachments.
 - 1. Precast and cast in-place vaults and covers
 - 2. Wiring diagrams for alarm devices
- D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.
- B. Comply with the following requirements and standards:
 - 1. NSF 61: "Drinking Water System Components-Health Effects" for materials for potable water.
- C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.08 MATERIAL DELIVERY, STORAGE AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.
- C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. During Storage: Use precautions for valves, including fire hydrants according to the following.
 - 1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
 - 2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.
- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.
- I. Protect imported bedding and backfill material from contamination by other materials.

1.09 COORDINATION

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

2.01 PVC Pipe: Sizes 1/8 inch through 3 inch

- A. Pipe and Fittings: ASTM D1785, Schedule 40.
- B. Joints: Restrain with solvent cement. Do not use threaded pipe.
- C. Solvent Cement: ASTM D2564.

2.02 EXPANSION JOINT

- A. An expansion joint shall be installed at location indicated on the Plans and shall be manufactured of ductile iron conforming to the material properties of AWWA C153.
- B. Separation beyond the maximum extension of the expansion joint shall be prevented without the use of external tie rods.
- C. The expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.
- D. All pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of AWWA C213, and shall be tested with a 1500 volt spark test conforming to stated specification.

2.03 THRUST BLOCKS

- A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.
- B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.
- C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.04 IDENTIFICATION MATERIALS AND DEVICES

- A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed black-letter, not less than ¾ inch high, message reading “CAUTION: WATER MAIN BELOW”.
- B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

- A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.
- B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00 – Utility Trenching and Backfill.

- C. 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 manufacturer's recommendations.
- D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 6. Support pipe at proper elevation and grade.
 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 10. Make proper provision for expansion and contraction of pipelines.
 11. Keep trenches free of water until joints have been properly made.
 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
- E. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 4. Splice wire with a splicing device consisting of an electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- F. 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.
- G. 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. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not

exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

H. Connections to Existing Lines:

1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.02 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.

B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

C. Jointing:

1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

D. Pipe Anchorage:

1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.03 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.04 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. Preparation for Test

1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
5. A joint previously tested in accordance with this specification may be covered or insulated.

6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
 7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.
- C. Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

3.05 CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Owner will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.06 DISINFECTION OF PIPELINES

- A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.
- B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Owner in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.

- C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.
- D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.
- E. The Contractor shall rechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.07 BACTERIOLOGICAL TESTING

- A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Owner.
- B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Owner.
- C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.
- D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-sheen bacteria per 100 ml, and when the turbidity is no greater than the source water.
- E. Samples shall be taken no sooner than 24 hours after final flushing.
- F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.
- G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION 33 30 00

SECTION 33 30 00
SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sanitary gravity sewers up to five feet from any on-site building.

1.02 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfill
- B. Section 32 13 13 – Concrete Paving

1.03 RELATED DOCUMENTS

A. AASHTO

- 1. M199: Standard Specification for Precast Reinforced Concrete Manhole Sections

B. ASTM

- 1. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- 2. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
- 3. C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- 4. C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- 5. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
- 6. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
- 7. C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
- 8. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
- 9. D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- 10. D4101: Standard Specification for Propylene Injection and Extrusion Materials
- 11. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- 12. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA

- 1. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
- 2. M23: PVC Pipe – Design and Installation

- D. Federal Specification
 - 1. SS-S-00210 (GSA-FSS)

1.04 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. DIP: Ductile iron pipe
- E. PVC: Polyvinyl Chloride
- F. NPS: Nominal pipe size

1.05 SUBMITTALS

- A. Follow submittal procedure outlined in Division 1 of the Technical Specifications.
- B. Product data for the following:
 - 1. Piping materials and fittings
 - 2. Special pipe couplings
 - 3. Joint sealants
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
 - 1. Precast concrete manholes, frames and covers
- D. Field Test Reports: Indicate test results for compliance with performance.

1.06 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

2.01 PVC PIPE

- A. Pipe:
 1. 4 inch through 15 inch: ASTM D3034, SDR 26
- B. Bell and spigot joints
- C. Fittings:
 1. 4 inch through 27 inch: ASTM F1336
- D. Joint Gasket: Elastomeric seal, ASTM F477
- E. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.02 JOINT SEALANT FOR 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 the Henry Company, or equal.

2.03 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast 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.

PART 3 - EXECUTION

3.01 GRAVITY 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 D2321 for plastic pipe, chapter 11.3.3 of AWWA M41 for ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 - 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.

3.02 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA M23.
- B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- C. Jointing:
 - 1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 - 2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 - 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 - 5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 - 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- D. Pipe Anchorage:
 - 1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.03 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

3.04 GRAVITY PIPELINE AIR TESTING AND FLUSHING

- A. All new sections of sanitary sewer shall be tested using the following procedures:
 - 1. Test is conducted between two consecutive manholes, or as directed by the Project Manager.
 - 2. The test section of the sewer shall be plugged at each end. One of the plugs used at the manhole shall be tapped and equipped for the air inlet connection for filling the line from an air compressor.

3. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowout.
4. Connect air hose to tapped plug selected for the air inlet. Connect the other end of the air hose to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate into the sewer test section, and to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.40 psi.
5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.
6. Supply air to the test section slowly, filling the pipeline until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap plug, release the pressure in the line and tighten all leaky caps and plugs. Start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipeline has been refilled.
8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gauge until the air pressure reached 3.0 psig. At 3.0 psig, commence timing with a stopwatch until the pressure drops to 2.5 psig, at which time the stop watch is stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 psig is used to compute the air loss.
9. If the time, in minutes and seconds, for the air pressure drop from 3.0 to 2.5 psi is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at any time.
10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

Requirements for Air Testing

Pipe Size (in inches)	Time	
	Minutes	Seconds
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
14	8	56

15	9	35
16	10	12
18	11	34
20	12	30

11. For 8 inch and smaller pipe, only: if, during the 5 minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.

12. Multi-pipe sizes: when the sewer line undergoing test is 8 inch or larger diameter pipe and includes 4 inch or 6 inch laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Project Manager can compute the “average” size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the “averaged” diameter pipe.

13. Adjustment Required for Groundwater:
 - a. An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.
 - b. Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.
 - 1) Install a ½ inch diameter pipe nipple (threaded one or both ends, approximately 10 inch long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.
 - 2) Seal pipe nipple with a threaded ½ inch cap.
 - 3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstruction, and then connecting a clear plastic tube to the pipe nipple.
 - 4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.
 - 5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of sewer pipe.
 - 6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

- B. After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or other debris that is flushed out during cleaning.

3.05 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.
- E. Pull-Through Device:
 - 1. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - 2. 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.
- F. 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.
- G. 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.

H. 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.

3.06 CLEANING

A. Thoroughly clean sewer lines and manholes of sediments, dirt, debris, and obstructions of any kind.

3.07 TELEVISION INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the sewer 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 Owner 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 33 30 00

BID FORMS

CITY OF SANTA ROSA

STATE OF CALIFORNIA

FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

The work to be performed and referred to herein is in the City of Santa Rosa, California and consists of improvements to be constructed in accordance with the provisions of the Invitation for Bids, containing the Notice to Bidders, the Special Provisions, the Project Plan(s), the Bid Forms and the Contract, all of which are by reference incorporated herein, and each Addendum, if any is issued, to any of the above which is also incorporated by reference herein.

TO THE AWARD AUTHORITY OF THE CITY OF SANTA ROSA

The undersigned, as bidder, declares that the only person or parties interested in this bid as principals are those named herein; that this bid is made without collusion with any other person, firm, or corporation; that Contractor has carefully examined the Project Plans, Invitation for Bids and conditions therefor, and is familiar with all bid requirements, that Contractor has examined this Contract and the provisions incorporated by reference herein, and Contractor hereby proposes, and agrees that if its bid is accepted by the City, Contractor will provide all necessary machinery, tools, apparatuses, and other means of construction, and to do all the work and furnish all the materials and services required to complete the construction in accordance with the Contract, the Special Provisions, the Project Plan(s), and Addenda to any of the above as incorporated by reference, in the time stated herein, for the unit prices and/or lump sum prices as follows:

NAME OF BIDDER: _____

Contract #: C02336

Project Title: FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

Line #	Description	Units	Quantity	Unit Price	Total Price
1	Finley Aquatic Center Spray Ground and Renovation Project	LS	1	\$_____	\$_____

In the case of any discrepancy between the unit price and the total set forth for the item, the unit price shall prevail; provided, however, that if the amount set forth as a unit price is ambiguous, unintelligible or uncertain for any reason, or is omitted, or in the case of lump sum items, is not the same amount as the entry in the "Total" column, then the amount set forth in the "Total" column for the item shall prevail in accordance with the following:

1. As to lump sum items, the amount set forth in the "Total" column shall be the unit price;
2. As to unit basis items, the amount set forth in the "Total" column shall be divided by the estimated quantity for the item and the price thus obtained shall be the unit price.

The Total Base Bid shall be the sum of the "Total" column. In case of discrepancy between the sum of the "Total" column and the amount entered as Total Base Bid, the sum of the "Total" column shall prevail. The bid comparison will be based on the sum of the "Total" column for each bidder.

If this Contract Bid is accepted by the City and the undersigned fails to execute the Contract and to give all the bonds required under the Contract, with a surety satisfactory to the Award Authority of the City of Santa Rosa, within ten calendar days after bidder has received the Notice of Award from the Engineer, then the Award Authority may, at its option, determine that the bidder has abandoned the Contract, and thereupon this bid and the acceptance thereof shall be null and void, and the forfeiture of the security accompanying this bid shall be in accordance with California Public Contract Code section 20172.

The undersigned understands and agrees that the City is not responsible for any error or omissions on the part of the undersigned in making this bid.

The bidder to whom the Contract is awarded agrees to execute the Contract in favor of the City, in the form attached, and to deliver any and all required bond(s) and insurance certificates within ten calendar days from the date of Contractor's receipt of the Notice of Award. Following the award of the Contract, Contractor shall commence work within ten calendar days from the day authorized in the Notice to Proceed and diligently prosecute the same to completion in accordance with Section 8-1.04.

LIST OF SUBCONTRACTORS

NAME OF BIDDER: _____

The following is a list of each subcontractor who will perform work or labor or render services to the undersigned for the construction of the project in an amount in excess of ½ of 1% of the total amount of this bid.

The undersigned agrees that any portion of the work in excess of ½ of 1% of the total amount of this bid and for which no subcontractor is designated herein will be performed by the undersigned.

SUBCONTRACTOR NAME	SUBCONTRACTOR LICENSE NUMBER	SUBCONTRACTOR DIR REGISTRATION NUMBER	SUBCONTRACTOR BUSINESS ADDRESS	DESCRIPTION OF WORK (ITEM NO.)

NONCOLLUSION DECLARATION
TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

The undersigned declares:

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

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

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

NOTE: The above Noncollusion Declaration is part of the Contract Bid. Signing this Bid on the signature portion thereof shall also constitute signature of this Noncollusion Declaration.

BID BOND AFFIDAVIT AND BIDDER'S SIGNATURE PAGE

Accompanying this bid is a guaranty in the form of (Notice: Insert the words "cash \$," "Cashier's Check," "Certified Check," or "Bidder's Bond" as the case may be):

in an amount equal to at least ten percent of the total of this bid.

The undersigned further agrees that if Contractor does not execute the Contract and deliver the necessary bonds to the City within the period of time specified in this Invitation for Bids, the proceeds of the security accompanying this bid shall become the property of the City of Santa Rosa, California, and this bid and the acceptance thereof may, at the option of the City, be considered null and void.

The undersigned is licensed in accordance with an act providing for the registration of Contractors, License No. _____, Class _____, expiration date _____.

The undersigned is registered with the Department of Industrial Relations, Registration No. _____.

IMPORTANT NOTICE: If bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer, and manager of the corporation; if a partnership, state true name of partnership, also the names of all partners in the partnership; if the bidder is a sole proprietor, state the business name and the proprietor's name in full.

Secretary of State Business Entity Number: _____.

Business Address

Telephone Number

I declare under penalty of perjury that the foregoing is true and correct.

BIDDER'S SIGNATURE: _____

TITLE: _____

DATE: _____

CONTRACT

CITY OF SANTA ROSA

CALIFORNIA

CONTRACT NO. C02336

FINLEY AQUATIC CENTER SPRAY GROUND AND RENOVATION PROJECT

This Contract is made and entered into as of date to be added upon award at Santa Rosa, California, between the City of Santa Rosa ("City") and _____ of _____ ("Contractor").

ARTICLE I - For and in consideration of the payment and agreement hereinafter mentioned, to be made and performed by City, and under the conditions expressed in the required bonds hereunto annexed, Contractor agrees that for the benefit of City, at its own cost and expense, to do all the work and furnish all the materials, except such as are mentioned in the Special Provisions to be furnished by City, necessary to construct and complete the work herein described in a good, workmanlike, and substantial manner. The work embraced herein shall be done in accordance with the Standard Specifications of the State of California Department of Transportation, dated 2010, insofar as the same may apply (Standard Specifications); in accordance with the City of Santa Rosa Construction Specifications for Public Improvements (City Specifications); in accordance with the City of Santa Rosa Design and Construction Standards, (City Standards); in accordance with the State of California Department of Transportation Standard Plans, dated 2010 (Standard Plans), (collectively, "Contract Documents") and in accordance with the Special Provisions hereinabove set forth, all of which are hereby incorporated into and made part of this Contract.

The work to be performed is further shown upon a plan consisting of 68 sheets entitled, Finley Aquatic Center Spray Ground and Renovation Project, File Number 2022-014, approved by the Deputy Director of Transportation and Public Works, hereinafter referred to as the Project Plan(s).

ARTICLE II - Contractor agrees to receive and accept the following prices as full compensation for furnishing all materials and doing all the work contemplated and embraced in this Contract; also for all loss or damages arising out of the nature of the work aforesaid, or from the acts of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered in the prosecution of the work until its acceptance by City and for all expenses incurred by or in consequence of the suspension or discontinuance of work, and for well and faithfully completing the work, and the whole thereof in the manner and according to the Project Plans and Invitation for Bids therefor, and the requirements of the Engineer under them to wit:

ITEM NUMBER	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
			\$ _____	\$ _____
TOTAL BASE BID (SUM OF "TOTAL" COLUMN)			\$ _____	

**BID ITEMS IN THIS SECTION WILL BE INSERTED
UPON AWARD OF THE CONTRACT AND SHALL BE
THE SAME AS THOSE BID UPON.**

ARTICLE III - City and Contractor hereby promise and agree that Contractor shall provide the materials and do the work according to the terms and conditions herein contained and referred to, for the prices aforesaid, and City hereby agrees to pay for the same at the time, in the manner, and upon the conditions set forth; and the parties for themselves, their heirs, executors, administrators, successors, and assigns, do hereby agree to full performance of the covenants herein stated.

ARTICLE IV - By execution of this Contract, Contractor hereby represents and certifies that Contractor is aware of the provisions of Labor Code section 3700 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 Contractor hereby agrees to comply with such provisions before commencing the performance of the work of this Contract.

ARTICLE V - It is further expressly agreed by and between the parties hereto that the Invitation for Bids, containing the Notice to Bidders including any required Bonds, the Contract Documents, and any Addenda are all essential parts of this Contract and are specially referred to and by such reference made a part hereof. In the event of any conflict in the provisions thereof, the terms of said documents shall control each over the other, in the following order:

1. Special Provisions
2. Project Plans
3. City Standards
4. City Specifications
5. Standard Specifications
6. Standard Plans

ARTICLE VI - Contractor agrees to commence work pursuant to this Contract within ten calendar days from the date authorized in the Notice to Proceed and to diligently prosecute the same to completion in accordance with Section 8-1.04C of the Special Provisions.

This Contract shall not be transferred or assigned without the prior written consent of City, which may be withheld by City in its sole and absolute discretion.

If Contractor is a corporation, two corporate officers of Contractor, one from each of the following two groups shall execute this Contract: a) the chairman of the board, president or any vice-president; b) the secretary, any assistant secretary, chief financial officer, or any assistant treasurer. The name and title of the corporate officers shall be printed under the signature.

In witness whereof, the parties hereto have executed this Contract as of the date first written above.

City:

City of Santa Rosa,
a Municipal corporation

By: _____

Title: _____

ATTEST:

By: _____

Title: _____

Approved as to form:

By: _____

Office of City Attorney

Contractor:

Name of Contractor,
Type of entity

By: _____

Name: _____

Title: _____

By: _____

Name: _____

Title: _____