

City of San Diego

CONTRACTOR'S NAME: THARSOS, INC.

ADDRESS: 7839 UNIVERSITY AVE, # 210, LA MESA, CA 91942

TELEPHONE NO.: 619-464-1261

FAX NO.: 619-241-8514

CITY CONTACT: Lisa Nguyen - Contract Specialist, Email: LTNguyen@sandiego.gov

Phone No. (619) 533-3435, Fax No. (619) 533-3633

B.Vitelle/H.McLintock/Lad

CONTRACT DOCUMENTS



FOR ORIGINAL

SBWRP Sludge Pump & Grinder Installation

BID NO.: _____ L-16-1374-DBB-2

SAP NO. (WBS/IO/CC): _____ B-14167

CLIENT DEPARTMENT: _____ 2000

COUNCIL DISTRICT: _____ 8

PROJECT TYPE: _____ BO

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- COMPETITION RESTRICTED TO: SLBE-ELBE or ELBE FIRMS ONLY .
- PREVAILING WAGE RATES: STATE FEDERAL
- APPRENTICESHIP

BID DUE DATE:

1:30 PM

NOVEMBER 12, 2015

CITY OF SAN DIEGO

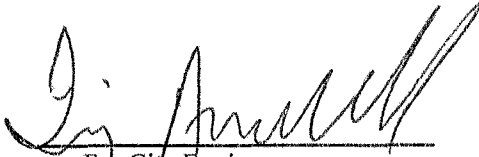
PUBLIC WORKS CONTRACTS

1010 SECOND AVENUE, 14th FLOOR, MS 614C

SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:



For City Engineer

10-8-15

Date



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CITY OF SAN DIEGO, CALIFORNIA

NOTICE INVITING BIDS

1. **FULL AND OPEN COMPETITION:** This contract may only be bid by the Contractors on the City's approved Prequalified Contractor's List (see Notice Inviting Bids, Prequalification of Contractors) and SLBE-ELBE Construction **LIMITED COMPETITION** Contractors List in accordance with the designation stated on the cover page hereof. For information regarding the SLBE-ELBE Construction Program and registration visit the City's web site: <http://www.sandiego.gov>.
2. **SUMMARY OF WORK:** The Work involves furnishing all labor, materials, equipment, services, and other incidental works and appurtenances for the construction of the Project as described in ATTACHMENT A.
3. **PRE-BID MEETING:**
 - 3.1. There will be a Pre-Bid Meeting to discuss the scope of the Project, bidding requirements, pre-qualification process, and Equal Opportunity Contracting Program requirements and reporting procedures in the Public Works Contracts, Conference Room at 1010 Second Avenue, 14th Floor, San Diego, CA 92101 **at 10:00 A.M., on October 27, 2015.**
 - 3.2. All potential bidders are encouraged to attend.
4. **PRE-BID SITE VISIT:** The prospective Bidders are encouraged to visit the Work Site with the Engineer. The purpose of the Site visit is to acquaint Bidders with the Site conditions. To request a sign language or oral interpreter for this visit, call the Public Works Contracts at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. A Pre-Bid Site Visit is offered when the details are provided as follows:

Time: 11:00am
Date: October 27, 2015
Location: 2411 Dairy Road, San Diego, CA 92154
5. **PREQUALIFICATION OF CONTRACTORS:**
 - 5.1. Contractors submitting Bid must be pre-qualified for the total amount proposed, inclusive of all alternate items prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award. Complete information and links to the on-line prequalification application are available at:

<http://www.sandiego.gov/cip/bidopps/prequalification.shtml>
 - 5.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening. For additional information or the answer to questions about the prequalification program, contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.
 - 5.3. As a result of the City's fiduciary requirement to safeguard vendor data, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on [PlanetBids™](#).

INSTRUCTIONS TO BIDDERS

1. **ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS:** Bids will be received in **electronic format (eBids) EXCLUSIVELY** at the City of San Diego's electronic bidding (eBidding) site, at: <http://www.sandiego.gov/cip/bidopps/index.shtml> and are due by the date, and time shown on the cover of this solicitation for the performance of work on **SBWRP Sludge Pump & Grinder Installation (Project)**.
 - 1.1. **BIDDERS MUST BE PRE-REGISTERED** with the City's bidding system and possess a system-assigned Digital ID in order to submit an electronic bid.
 - 1.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.
 - 1.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.
 - 1.4. **BIDS REMAIN SEALED UNTIL BID DEADLINE.** eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter which has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it desire to do so.
 - 1.5. **BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME.** Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.
 - 1.6. Unit prices shall be entered for all unit price items. Unit prices shall not exceed two (2) decimal places. If the Unit prices entered exceed two (2) decimal places, the City will only use the first two digits after the decimal points without rounding up or down.
 - 1.7. **RECAPITULATION OF THE WORK.** Bids shall not contain any recapitulation of the Work. Conditional Bids will be rejected as being **non-responsive**. Alternative proposals will not be considered unless called for.

1.8. BIDS MAY BE WITHDRAWN by the Bidder prior to, but not after, the time fixed for opening of bids.

1.8.1. Important Note: Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.

1.9. ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE. To request a copy of this solicitation in an alternative format, contact the Public Works Contract Specialist listed in the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

2. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT

2.1. The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.

2.2. By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.

2.3. The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.

2.4. The Bidder agrees to the construction of the project as described in Attachment "A-Scope of Work" for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at \$500,000 or less) from the date of Bid opening. The duration of the Contract Price guarantee may be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.

3. BIDS ARE PUBLIC RECORDS: Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.

4. SUBCONTRACTING PARTICIPATION PERCENTAGES:

- 4.1. The City has incorporated voluntary subcontractor participation percentage to enhance competition and maximize subcontracting opportunities as follows.
- 4.2. The following voluntary subcontractor participation percentage for DBE, DVBE, WBE, MBE, SLBE, and ELBE certified Subcontractors shall apply to this contract:

Total voluntary subcontractor participation percentage for this project is 10.1%.

- 4.3. For additional Equal Opportunity Contracting Program requirements, see Attachment C.

5. CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:

- 5.1. **Prior** to the Award of the Contract or each Task Order, you and your Subcontractors and Suppliers must register with the City's web-based vendor registration and bid management system. For additional information go to:

<http://www.sandiego.gov/purchasing/bids-contracts/vendorreg.shtml>.

- 5.2. The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.

- 6. **JOINT VENTURE CONTRACTORS:** Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receiving the Contract forms. See 2-1.1.2, "Joint Venture Contractors" in The WHITEBOOK for details.

- 7. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding \$25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding \$15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.

- 7.1. **Compliance with Prevailing Wage Requirements.** Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.

- 7.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>. Contractor

and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.

7.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.

7.2. Penalties for Violations. Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed.

7.3. Payroll Records. Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.

7.3.1. For contracts entered into on or after April 1, 2015, Contractor and their subcontractors shall furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.

7.4. Apprentices. Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.

7.5. Working Hours. Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on

design professionals and subcontractors of \$25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections 1810 through 1815.

- 7.6. Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.
- 7.7. Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that “I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers’ compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.”
- 7.8. Labor Compliance Program.** The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego’s Equal Opportunity Contracting Department at 619-236-6000.
- 7.9. Contractor and Subcontractor Registration Requirements.** This project is subject to compliance monitoring and enforcement by the DIR. As of March 1, 2015, no contractor or subcontractor may be listed on a bid or proposal for a public works project unless registered with the DIR pursuant to Labor Code section 1725.5. As of April 1, 2015, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, or enter into any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code section 1725.5. By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration to the City upon request.
- 7.9.1.** A Contractor’s inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.

8. INSURANCE REQUIREMENTS:

- 8.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City's Notice of Intent to Award letter.
- 8.2. Refer to sections 7-3, "LIABILITY INSURANCE", and 7-4, "WORKERS' COMPENSATION INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

9. REFERENCE STANDARDS: Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction ("The GREENBOOK")	2012	PITS070112-01
City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK")*	2012	PITS070112-02
City of San Diego Standard Drawings*	2012	PITS070112-03
Caltrans Standard Specifications	2010	PITS070112-04
Caltrans Standard Plans	2010	PITS070112-05
California MUTCD	2012	PITS070112-06
City Standard Drawings - Updates Approved For Use (when specified)*	Varies	Varies
Standard Federal Equal Employment Opportunity Construction Contract Specifications and the Equal Opportunity Clause Dated 09-11-84	1984	769023
NOTE:	*Available online under Engineering Documents and References at: http://www.sandiego.gov/publicworks/edocref/index.shtml	

10. CITY'S RESPONSES AND ADDENDA: The City, at its option, may respond to any or all questions submitted in writing via the City's eBidding web site in the **form of an addendum**. No other responses to questions, oral or written, shall be of any force or effect with respect to this solicitation.. The changes to the Contract Documents through addendum are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.

11. CITY'S RIGHTS RESERVED: The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.

12. CONTRACT PRICING FORMAT: This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein.

- 12.1. Bids shall not contain any recapitulation of the Work. Conditional Bids will be rejected as being non-responsive. Alternative proposals will not be considered unless called for.
- 12.2. The Bidder agrees to the construction of **SBWRP Sludge Pump & Grinder Installation** for the City of San Diego, in accordance with these contract documents for the prices listed below. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at \$500,000 or less) from the date of Bid opening to Award of the Contract. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent e.g., bond and insurance.
- 12.3. Unit prices shall be entered for all unit-price items. Unit prices shall not exceed two (2) decimal places. If the Unit prices entered exceeds two (2) decimal places, the City will only use the first two digits after the decimal points without rounding up or down.

13. SUBCONTRACTOR INFORMATION:

- 13.1. **LISTING OF SUBCONTRACTORS.** In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR, CONSULTANT** or **SUPPLIER**. The Bidder shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement may result in the Bid being rejected as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.
- 13.2. **LISTING OF SUPPLIERS.** Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME, LOCATION (CITY)** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.

- 13.3. LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES.**
For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note “ALTERNATE” and alternate item number within the description.
- 14. SUBMITTAL OF “OR EQUAL” ITEMS:** See Section 4-1.6, “Trade Names or Equals” in The WHITEBOOK and as amended in the SSP.
- 15. AWARD PROCESS:**
- 15.1.** The Award of this contract is contingent upon the Contractor’s compliance with all conditions precedent to Award.
- 15.2.** Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.
- 15.3.** This contract will be deemed executed, and effective, only upon the signing of the Contract by the Mayor or designee of the City and approval as to form the City Attorney’s Office.
- 15.4.** The low Bid will be determined by Base Bid alone.
- 15.5.** Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base bid alone.
- 16. SUBCONTRACT LIMITATIONS:** The Bidder’s attention is directed to Standard Specifications for Public Works Construction, Section 2-3, “SUBCONTRACTS” in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.
- 17. AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City’s website: <http://www.sandiego.gov/cip/>. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracts.
- 18. SUBMISSION OF QUESTIONS:**
- 18.1.** The Director (or designee), of the Public Works Department is the officer responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. All questions related to this solicitation shall be submitted to:
- Public Works Contracts
1010 Second Avenue, 14th Floor
San Diego, California, 92101
Attention: [Contract Specialist listed on the front cover hereof]

OR:

Email address of the Contract Specialist listed on the front cover hereof.

- 18.2. Questions received less than 14 days prior to the date for opening of Bids may not be considered.
- 18.3. Clarifications deemed by the City to be material shall be issued by Addenda and uploaded to the City's online bidding service.
- 18.4. Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to become informed of any Addenda that have been issued and to include all such information in its Bid.
19. **ONLY ONE BID PER CONTRACTOR SHALL BE ACCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.
20. **SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, first floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.
21. **BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY):**
- 21.1. For bids \$250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.
- 21.2. This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.
- 21.3. The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.
- 21.4. At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of

San Diego, the bid security must be uploaded to the City's eBidding system. Within twenty-four (24) hours after the bid due date and time, the first five (5) apparent low bidders must provide the City with the original bid security.

- 21.5. Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original within twenty-four (24) hours may cause the bid to be rejected and deemed **non-responsive**.

22. AWARD OF CONTRACT OR REJECTION OF BIDS:

- 22.1. This contract may be awarded to the lowest responsible and reliable Bidder.
- 22.2. Bidders shall complete the entire Bid schedule (also referred to as "schedule of prices" or Proposal form). Incomplete price schedules may be rejected as being non-responsive.
- 22.3. The City reserves the right to reject any or all Bids, and to waive any informality or technicality in Bids received and any requirements of these specifications as to bidding procedure.
- 22.4. Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City from the Bidder within 3 Working Days, excluding Saturdays, Sundays, and state holidays, after the opening of Bids, of written notice which includes proof of honest, credible, clerical error of material nature, free from fraud or fraudulent intent, and of evidence that reasonable care was observed in the preparation of the Bid.
- 22.5. A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with section 22.3017 of the San Diego Municipal Code.
- 22.6. The City of San Diego will not discriminate with regard to race, religious creed, color, national origin, ancestry, physical handicap, marital status, sex or age, in the award of contracts.
- 22.7. Each Bid package properly executed as required by these specifications shall constitute a firm offer, which may be accepted by the City within the time specified in the Proposal.
- 22.8. The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of any proposed alternates, additive items or options as detailed herein.

23. BID RESULTS:

- 23.1. The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.

23.2. To obtain Bid results, visit the City's eBidding site, request results via e-mail to the "City Contact" person listed in the title page of these documents, or via courier, personal delivery or U.S. Postal service delivery of a request for results accompanied by provide a self-addressed, stamped envelope, referencing bid number and bid tabulations will be mailed. Bid results cannot be given over the telephone.

24. THE CONTRACT:

24.1. The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

24.2. If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

24.3. If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.

24.4. Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.

24.5. The award of the Contract is contingent upon the satisfactory completion of the above mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.

25. EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK: The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents). The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character,

quality, and scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.

26. CITY STANDARD PROVISIONS: This contract is subject to the following standard provisions. See The WHITEBOOK for details.

26.1. The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.

26.2. The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.

26.3. The City of San Diego Municipal Code §22.3004 for Pledge of Compliance.

26.4. The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

26.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

26.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).

26.7. The City's Information

27. PRE-AWARD ACTIVITIES:

27.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified in the herein and in the Notice of Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive**.

The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City

**CONTRACT AGREEMENT AND
PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND**

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and THARSOS, INC., herein called "Contractor" for construction of **SBWRP Sludge Pump & Grinder Installation** Bid No. **L-16-1374-DBB-2** in the amount of THREE HUNDRED SEVENTY SIX THOUSAND FIVE HUNDRED DOLLARS AND ZERO CENTS (\$376,500.00), which is comprised of the Base Bid alone.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

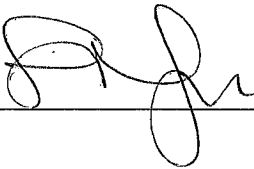
1. The following are incorporated into this contract as though fully set forth herein:
 - (a) The attached Faithful Performance and Payment Bonds.
 - (b) The attached Proposal included in the Bid documents by the Contractor.
 - (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).
 - (d) That certain documents entitled **SBWRP Sludge Pump & Grinder Installation**, on file in the office of the Public Works Department as Document No. **B-14167**, as well as all matters referenced therein.
2. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **SBWRP Sludge Pump & Grinder Installation**, Bid Number **L-16-1374-DBB-2**, San Diego, California.
3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances.
4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.
5. This contract is effective as of the date that the Mayor or designee signs the agreement.


CONTRACT AGREEMENT (continued)

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 authorizing such execution.

THE CITY OF SAN DIEGO

APPROVED AS TO FORM

By 

Jan I. Goldsmith, City Attorney
By 

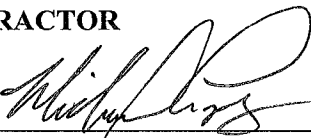
Print Name: _____
Lisa Nguyen, Contract Specialist

Print Name: Christina Leon
Deputy City Attorney

Date: 1/29/16

Date: 2/1/16

CONTRACTOR

By 

Print Name: Michael Lopez

Title: President

Date: 12/1/2015

City of San Diego License No.: B2015020741

State Contractor's License No.: 980621

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000012874

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

_____ THARSOS, INC. _____, a corporation, as principal, and
_____ RLI INSURANCE COMPANY _____, a corporation authorized to do
business in the State of California, as Surety, hereby obligate themselves, their successors and assigns,
jointly and severally, to The City of San Diego a municipal corporation in the sum of
THREE HUNDRED SEVENTY SIX THOUSAND FIVE HUNDRED DOLLARS AND ZERO
CENTS (\$376,500.00) for the faithful performance of the annexed contract, and in the sum of
THREE HUNDRED SEVENTY SIX THOUSAND FIVE HUNDRED DOLLARS AND ZERO
CENTS (\$376,500.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract **SBWRP Sludge Pump & Grinder Installation**, Bid Number **L-16-1374-DBB-2**, San Diego, California then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvements commencing with Civil Code Section 9100 of the Civil Code of the State of California..

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

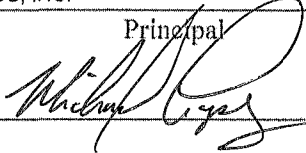
PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND
(continued)

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated NOVEMBER 24, 2015

Approved as to Form

THARSOS, INC.
Principal

By 

MICHAEL LOPEZ, PRESIDENT
Printed Name of Person Signing for Principal

Jan I. Goldsmith, City Attorney

By 
Deputy City Attorney

RLI INSURANCE COMPANY
Surety

By 
MARK D. IATAROLA, Attorney-in-fact

Approved:

By 
Lisa Nguyen, Contract Specialist

111 PACIFICA, SUITE 350
Local Address of Surety

IRVINE, CA 92618
Local Address (City, State) of Surety

949/341-9169
Local Telephone No. of Surety

PREMIUM IS FOR CONTRACT TERM
AND IS SUBJECT TO ADJUSTMENT
BASED ON FINAL CONTRACT PRICE

Premium \$ 5,983.00

Bond No. CSB0023649

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

CIVIL CODE § 1189

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of SAN DIEGO)

On 11/24/2015 before me, MICHELLE M. BASUIL, NOTARY PUBLIC
Date Here Insert Name and Title of the Officer

personally appeared MARK D. IATAROLA
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/~~her/their~~ authorized capacity(ies), and that by his/~~her/their~~ signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.



Signature *Michelle M. Basuil*
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____ Document Date: _____
Number of Pages: _____ Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: MARK D. IATAROLA
 Corporate Officer — Title(s): _____
 Partner — Limited General
 Individual Attorney in Fact
 Trustee Guardian or Conservator
 Other: _____
Signer Is Representing: _____

Signer's Name: _____
 Corporate Officer — Title(s): _____
 Partner — Limited General
 Individual Attorney in Fact
 Trustee Guardian or Conservator
 Other: _____
Signer Is Representing: _____



9025 N. Lindbergh Dr. | Peoria, IL 61615
Phone: (800)645-2402 | Fax: (309)689-2036

POWER OF ATTORNEY

RLI Insurance Company

Contractors Bonding and Insurance Company

Know All Men by These Presents:

That this Power of Attorney is not valid or in effect unless attached to the bond which it authorizes executed, but may be detached by the approving officer if desired.

That this Power of Attorney may be effective and given to either or both of **RLI Insurance Company** and **Contractors Bonding and Insurance Company**, required for the applicable bond.

That **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, each Illinois corporations (as applicable), each authorized and licensed to do business in all states and the District of Columbia do hereby make, constitute and appoint:

Mark D. Iatarola, Michelle M. Basuil, John Maloney, Helen Maloney, jointly or severally

in the City of Escondido, State of California, as Attorney in Fact, with full power and authority hereby conferred upon him/her to sign, execute, acknowledge and deliver for and on its behalf as Surety, in general, any and all bonds, undertakings, and recognizances in an amount not to exceed Ten Million Dollars (\$10,000,000.00) for any single obligation.

The acknowledgment and execution of such bond by the said Attorney in Fact shall be as binding upon this Company as if such bond had been executed and acknowledged by the regularly elected officers of this Company.

RLI Insurance Company and **Contractors Bonding and Insurance Company**, as applicable, have each further certified that the following is a true and exact copy of the Resolution adopted by the Board of Directors of each such corporation, and now in force, to-wit:

"All bonds, policies, undertakings, Powers of Attorney or other obligations of the Corporation shall be executed in the corporate name of the Corporation by the President, Secretary, any Assistant Secretary, Treasurer, or any Vice President, or by such other officers as the Board of Directors may authorize. The President, any Vice President, Secretary, any Assistant Secretary, or the Treasurer may appoint Attorneys in Fact or Agents who shall have authority to issue bonds, policies or undertakings in the name of the Corporation. The corporate seal is not necessary for the validity of any bonds, policies, undertakings, Powers of Attorney or other obligations of the Corporation. The signature of any such officer and the corporate seal may be printed by facsimile or other electronic image."

IN WITNESS WHEREOF, **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, as applicable, have caused these presents to be executed by its respective Vice President with its corporate seal affixed this 2nd day of October, 2015.

State of Illinois }
County of Peoria }

SS



RLI Insurance Company
Contractors Bonding and Insurance Company
B. W. Davis
Barton W. Davis Vice President

On this 2nd day of October, 2015, before me, a Notary Public, personally appeared Barton W. Davis, who being by me duly sworn, acknowledged that he signed the above Power of Attorney as the aforesaid officer of the **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, and acknowledged said instrument to be the voluntary act and deed of said corporation.

Jacqueline M. Bockler
Jacqueline M. Bockler Notary Public



CERTIFICATE

I, the undersigned officer of **RLI Insurance Company**, and/or **Contractors Bonding and Insurance Company**, each Illinois corporations, do hereby certify that the attached Power of Attorney is in full force and effect and is irrevocable; and furthermore, that the Resolution of the Company as set forth in the Power of Attorney, is now in force. In testimony whereof, I have hereunto set my hand and the seal of the **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company** this 24TH day of NOVEMBER 2015.

RLI Insurance Company
Contractors Bonding and Insurance Company
B. W. Davis
Barton W. Davis Vice President

ATTACHMENTS

ATTACHMENT A
SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** This project involves replacing the existing air driven pumps with new electric powered positive displacement sludge pumps and grinders. It will also include replacing two existing water-cooled air compressors with 2 air-cooled air compressors and supplying power to the new pumps and grinders.
 - 1.1. The Work shall be performed in accordance with:
 - 1.1.1. The Notice Inviting Bids and Plans 38388-01-D through 38388-28-D, inclusive.
2. **CONSTRUCTION COST:** The City's estimated construction cost for this contract is \$370,000.
3. **LOCATION OF WORK: The location of the Work is as follows:** 2411 Dairy Mart Road, San Diego, CA, 92154 (See Appendix E for Location Map.)
4. **CONTRACT TIME:** The Contract Time for completion of the Work shall be **80 Working Days**.
5. **CONTRACTOR'S LICENSE CLASSIFICATION:** In accordance with the provisions of California Law, the Contractor shall possess valid appropriate license(s) at the time that the Bid is submitted. Failure to possess the specified license(s) shall render the Bid as **non-responsive** and shall act as a bar to award of the Contract to any Bidder not possessing required license(s) at the time of Bid.
 - 5.1. The City has determined the following licensing classifications for this contract:
 - CLASS A

ATTACHMENT B
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ATTACHMENT C
EQUAL OPPORTUNITY CONTRACTING PROGRAM

EQUAL OPPORTUNITY CONTRACTING PROGRAM REQUIREMENTS

1. To The WHITEBOOK, Chapter 10, Sections D and E, DELETE each in its entirety, and SUBSTITUTE with the following:

D. CITY'S EQUAL OPPORTUNITY COMMITMENT.

1. Nondiscrimination in Contracting Ordinance.

1. The Contractor, Subcontractors and Suppliers shall comply with requirements of the City's Nondiscrimination in Contracting Ordinance, San Diego Municipal Code §§22.3501 through 22.3517.

The Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers. The Contractor shall provide equal opportunity for subcontractors to participate in subcontracting opportunities. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the contract and may result in contract termination, debarment, or other sanctions.

The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. Disclosure of Discrimination Complaints. As part of its Bid or Proposal, the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors, or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.
3. Upon the City's request, the Contractor agrees to provide to the City, within 60 days, a truthful and complete list of the names of all Subcontractors and Suppliers that the Contractor has used in the past 5 years on any of its contracts that were undertaken within San Diego County, including the total dollar amount paid by the Contractor for each subcontract or supply contract.
4. The Contractor further agrees to fully cooperate in any investigation conducted by the City pursuant to the City's Nondiscrimination in Contracting Ordinance, Municipal Code §§22.3501 through 22.3517. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the Contract and may result in remedies being ordered against the Contractor up to and including contract termination, debarment and other sanctions for violation of the provisions of the Nondiscrimination in Contracting Ordinance. The Contractor further understands and agrees that the procedures, remedies and sanctions provided for in the Nondiscrimination in Contracting Ordinance apply only to violations of the Ordinance.

E. EQUAL EMPLOYMENT OPPORTUNITY OUTREACH PROGRAM.

1. The Contractor, Subcontractors and Suppliers shall comply with the City's Equal Employment Opportunity Outreach Program, San Diego Municipal Code §§22.2701 through 22.2707.

The Contractor shall not discriminate against any employee or applicant for employment on any basis prohibited by law. Contractor shall provide equal opportunity in all employment practices. Prime Contractor shall ensure their subcontractors comply with this program. Nothing in this section shall be interpreted to hold a prime contractor liable for any discriminatory practice of its subcontractors.

The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. If the Contract is competitively solicited, the selected Bidder shall submit a Work Force Report (Form BB05), within 10 Working Days after receipt by the Bidder of Contract forms to the City for approval as specified in the Notice of Intent to Award letter from the City.
3. If a Work Force Report is submitted, and the City determines there are under-representations when compared to County Labor Force Availability data, the selected Bidder shall submit an Equal Employment Opportunity Plan.
4. If the selected Bidder submits an Equal Employment Opportunity Plan, it shall include the following assurances:
 1. The Contractor shall maintain a working environment free of discrimination, harassment, intimidation and coercion at all sites and in all facilities at which the Contractor's employees are assigned to work.
 2. The Contractor reviews its EEO Policy, at least annually, with all on-site supervisors involved in employment decisions.
 3. The Contractor disseminates and reviews its EEO Policy with all employees at least once a year, posts the policy statement and EEO posters on all company bulletin boards and job sites, and documents every dissemination, review and posting with a written record to identify the time, place, employees present, subject matter, and disposition of meetings.
 4. The Contractor reviews, at least annually, all supervisors' adherence to and performance under the EEO Policy and maintains written documentation of these reviews.
 5. The Contractor discusses its EEO Policy Statement with subcontractors with whom it anticipates doing business, includes the EEO Policy Statement in its subcontracts, and provides such documentation to the City upon request.

6. The Contractor documents and maintains a record of all bid solicitations and outreach efforts to and from subcontractors, contractor associations and other business associations.
7. The Contractor disseminates its EEO Policy externally through various media, including the media of people of color and women, in advertisements to recruit, maintains files documenting these efforts, and provides copies of these advertisements to the City upon request.
8. The Contractor disseminates its EEO Policy to union and community organizations.
9. The Contractor provides immediate written notification to the City when any union referral process has impeded the Contractor's efforts to maintain its EEO Policy.
10. The Contractor maintains a current list of recruitment sources, including those outreaching to people of color and women, and provides written notification of employment opportunities to these recruitment sources with a record of the organizations' responses.
11. The Contractor maintains a current file of names, addresses and phone numbers of each walk-in applicant, including people of color and women, and referrals from unions, recruitment sources, or community organizations with a description of the employment action taken.
12. The Contractor encourages all present employees, including people of color and women employees, to recruit others.
13. The Contractor maintains all employment selection process information with records of all tests and other selection criteria.
14. The Contractor develops and maintains documentation for on-the-job training opportunities, participates in training programs, or both for all of its employees, including people of color and women, and establishes apprenticeship, trainee, and upgrade programs relevant to the Contractor's employment needs.
15. The Contractor conducts, at least annually, an inventory and evaluation of all employees for promotional opportunities and encourages all employees to seek and prepare appropriately for such opportunities.
16. The Contractor ensures the company's working environment and activities are non-segregated except for providing separate or single-user toilets and necessary changing facilities to assure privacy between the sexes.

ATTACHMENT D
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ATTACHMENT E
SUPPLEMENTARY SPECIAL PROVISIONS

SUPPLEMENTARY SPECIAL PROVISIONS

The following Supplementary Special Provisions (SSP) modifies the following documents:

- 1) Standard Specifications for Public Works Construction (The GREENBOOK) currently in effect.
 - 2) The City of San Diego Standard Specifications for Public Works Construction (The WHITEBOOK).
-

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 TERMS AND DEFINITIONS.

Normal Working Hours. To the City Supplement, ADD the following:

The Normal Working Hours are 7:00 AM to 3:00 PM. Due to limited plant staff onsite, the contractor shall not work every other Friday unless otherwise approved by Resident Engineer.

SECTION 2 - SCOPE AND CONTROL OF WORK

2-3.2 Self Performance. DELETE in its entirety and SUBSTITUTE with the following:

1. You must perform, with your own organization, Contract work amounting to at least 50% of the base bid alone or base bid and any additive or deductive alternate(s) that together when added or deducted form the basis of award.
2. The self performance percentage requirement will be waived for contracts when a “B” License is required or allowed.

2-5.3.1 General. To the City Supplement, ADD the following

7. For products for which an AML (Approved Material List) is available, products listed in the AML shall be used. A submittal review will be conducted for products not identified on an AML on a case-by-case basis when:
 - a) The product type or category is not in the AML.

- b) The AML does not list at least two available manufacturers of the product.
- c) The material or manufacturer listed in the AML is no longer available. Documentation to substantiate the product is no longer available or in production is required as part of the submittal.

In the case of conducting a submittal review when required by the Plans or Special Provisions, or when requested by the Engineer, all submittals shall be accompanied by the City's submittal form.

The Product Submittal Form is available for download at:

<http://www.sandiego.gov/publicworks/edocref/index.shtml>

- 8. All submittals by you shall be submitted to the Engineer.
- 9. Unless otherwise noted, within 14 days after the date of commencement as stated in the Notice to Proceed, you shall submit the following items to the Engineer for review:
 - a) The final version of the draft submittals given to you by the Engineer at the Preconstruction Conference. You shall have reviewed and added items that you believe require approval or review prior to proceeding with specific work activities. This list shall include specification section numbers and description of the submittal. Scheduled submission dates and anticipated approval dates for all your submittals shall be included in the your Construction Schedule, which shall be prepared in accordance with the provisions of Section 6-1 of the current edition of the Standard Specifications for Public Works Construction.
- 10. A list of all permits and licenses you are required to obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.
- 11. You are responsible for identifying and delivering all submittals and/or permits required by the contract documents.

2-5.3.2

Working Drawings. TABLE 2-5.3.2(A), ADD the following:

Item	Section No.	Title	Subject
17	306-1.6	Water Valve Bypass for Mainlines 16" and Larger	SDW-154*

* Note: The distance dimensions shown between the bypass pipes and between bypass pipes and the mainlines are subject to change to field conditions.

2-5.3.3

Shop Drawings. ADD the following:

1. Wherever called for in the Contract Documents, you shall furnish to the Engineer for review, six (6) copies, plus one reproducible copy, of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. You shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, and process systems and equipment:
 - a) Wiring and control diagrams of systems and equipment.
 - b) Complete manufacturer's specifications, including materials description and paint system.
 - c) Samples of finish colors for selection.
 - d) Requirements for storage and protection prior to installation.
 - e) Installation procedures.
 - f) List of all requested exceptions to the Contract Documents and/or variations from the specified equipment.
2. All shop drawing submittals shall be accompanied by the Engineer's standard submittal transmittal form. The form may be obtained in quantity from the Engineer. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.
 - a) Sequentially number the transmittal forms. Resubmittals shall have original number with an alphabetic suffix.
 - b) Identify Contract, CONTRACTOR, Subcontractor and/or Supplier; pertinent drawing sheet and detail number(s), and specification section number, as appropriate. On standard drawings or data sheets, clearly indicate model and option being proposed and strike out all non-relevant data.
 - c) All submittals must be capable of being scanned electronically for filing on a computer file.
3. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.
4. Except as may otherwise be indicated herein, the Engineer will return Three (3) prints of each submittal to you with comments noted thereon, within 20

working days following their receipt by the Engineer . It is considered reasonable that you shall make a complete and acceptable submittal to the Engineer by the second submission of a submittal item. The Owner reserves the right to withhold monies due you to cover additional costs of the Engineer's and Consultant's review beyond the second submittal. The Engineer's and Consultant's maximum review period for each submittal, will be 20 working days per submittal and your resubmittal shall be made within 20 working days. Therefore, for a submittal that requires a second submittal before it is complete, the maximum period for that submittal could be 60 working days.

5. If 3 copies of a submittal are returned to you marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.
6. If 4 copies of a submittal are returned to you marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required, unless specifically required.
7. If a submittal is returned to you marked "REJECTED-RESUBMIT," you shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Engineer
8. Fabrication of an item shall be commenced only after the Consultant has reviewed the pertinent submittals and the Engineer has returned copies to you marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

All your shop drawing submittals shall be carefully reviewed by your authorized representative, prior to submission to the Engineer. Each submittal shall be dated, signed, and certified by you, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the Engineer of any your submittals will be made for any items which have not been so certified by you. All non-certified submittals will be returned to you without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of you.

9. The Engineer's and Consultant's review of your shop drawing submittals shall not relieve you of the entire responsibility for the correctness of details and dimensions. You shall assume all responsibility and risk for any misfits due to any errors your submittals. You shall be responsible for the dimensions and the design of adequate connections and details.
10. The Engineer may schedule a submittal conference to provide for a rapid review of a submittal, should the project schedule warrant such a review. The Engineer, Consultant, you, and a qualified manufacturer's representative shall attend the submittal conference.

ADD:

2-5.3.5 Owner's Manual

1. You shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. The OWNER'S MANUAL shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.
2. The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "part." "Parts" shall conform to the following (as applicable):
 - a) Part 1 - Equipment Summary
 - i. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - ii. Form: The Engineer will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. You shall fill in the relevant information on the form and include it in Part 1.
 - b) Part 2 - Operational Procedures
 - i. Procedures: Manufacturer-recommended procedures for the following shall be included in Part 2:
 - Installation
 - Adjustment
 - Start-up
 - Location of controls, special tools or other equipment required
 - Related instrumentation needed for operation
 - Operating Procedures
 - Load Changes
 - Calibration
 - Shutdown
 - Troubleshooting
 - Disassembly
 - Reassembly
 - Realignment
 - Testing to determine performance efficiency

Tabulation of proper settings for all pressure relief valves, low and high pressure switches and other protection devices

List of all electrical relay settings including alarm and contact settings

- c) Part 3 - Preventive Maintenance Procedures
 - i. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component and by leaving the equipment in place.
 - ii. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.
 - d) Part 4 - Parts List
 - i. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
 - ii. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.
 - e) Part 5 - Wiring Diagrams
 - i. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.
 - f) Part 6 - Shop Drawings
 - i. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.
 - g) Part 7- Safety
 - i. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
 - h) Part 8 - Documentation
 - i. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.
3. The CONTRACTOR shall furnish to the Engineer 7 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be labeled and bound in a standard size, 3-ring, loose leaf, vinyl plastic

hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals shall be prepared.

4. OWNER'S MANUALS shall be submitted in final form to the Engineer not later than the 75 percent of construction completion date. All discrepancies found by the Engineer in the OWNER'S MANUALS shall be corrected by you within 30 days from the date of written notification by the Engineer.
5. Your attention is directed to the condition that 5 percent of the contract price will be deducted from any monies due to you as progress payments, if at the 75 percent construction completion point, the approved OWNER'S MANUAL complying with this Section has not been submitted. The aforementioned amount will be retained by the OWNER as the agreed, estimated value of approved OWNER'S MANUALS. Any such retention of money for failure to submit the approved OWNER'S MANUALS on or before 75 percent construction completion point shall be in addition to the retention of any payments due to you as specified in Section 9 of the Standard Specification for Public Works Construction 2012 edition and the City Supplement
6. When available, from the equipment vendor, you shall submit one copy of available sections of the final OWNER'S MANUALS in an electronic media format. The information shall be provided on a compact disk in either Microsoft Word or Adobe Acrobat files.

ADD:

2-5.3.6 Spare Parts List

1. You shall furnish to the Engineer 7 copies of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. You shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be labeled and bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

2-9.1 Permanent Survey Markers. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Pursuant to Division 3, Chapter 15 of the Business and Professions Code, the Contractor shall not disturb survey monuments that "control the location of subdivisions, tracts, boundaries, roads, streets, or highways, or provide horizontal or vertical survey control" until they have been tied out by a Registered Land Surveyor or Registered Civil Engineer authorized to practice land surveying within the State of California.

Monument Preservation will be performed by City Public Works Field Engineering Division (PW-FED) Field Survey Section on all Projects, unless permission is obtained for these services in writing by PW-FED.

The Contractor shall submit to the Engineer a minimum of 7 Days prior to the start of the Work a list of controlling survey monuments which may be disturbed. The Agency (or the owner on a Private Contract) will:

- a) set survey points outside the affected work area that reference and locate each controlling survey monument that may be disturbed,
- b) file a Corner Record or Record of Survey with the County Surveyor after setting the survey points to be used for re-establishment of the disturbed controlling survey monuments, and
- c) file a Corner Record of Record of Survey with the County Surveyor after re-establishment of the disturbed controlling survey monuments.

2-15 TECHNICAL STUDIES AND DATA. To the City Supplement, ADD the following:

5. In preparation of the Contract Documents, the designer has relied upon the following reports of explorations and tests at the Work Site:
 1. Operations and Maintenance Manual
6. The report(s) listed above is(are) available for review by contacting the Contract Specialist or visiting:

[ftp://ftp.sannet.gov/OUT/ECP/AEP/South%20Bay%20Water%20Reclamation%20Plant%20\(SBWRP\)%20Sludge%20Pump%20Grinder%20Installation/](ftp://ftp.sannet.gov/OUT/ECP/AEP/South%20Bay%20Water%20Reclamation%20Plant%20(SBWRP)%20Sludge%20Pump%20Grinder%20Installation/)

SECTION 4 - CONTROL OF MATERIALS

4-1.3.4 Inspection Paid For By the Contractor. To the City Supplement, ADD the following:

- a) All special inspection involved with the work associated

4-1.3.6 Preapproved Materials. To the City Supplement, ADD the following:

3. You shall submit in writing a list of all products to be incorporated in the Work that are on the AML.

ADD:

4-1.3.7 Testing under the direction of the Engineer. When a bid item for Testing under the direction of the Engineer is provided, the Contractor must employ and pay for the services of a qualified third party independent laboratory to perform the required testing. The Contractor will be reimbursed for the cost of testing under this bid item.

4-1.6 Trade Names or Equals. ADD the following:

You must submit your list of proposed substitutions for “an equal” (“or equal”) item(s) **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on the City’s Product Submittal Form available at.

<http://www.sandiego.gov/publicworks/edocref/index.shtml>

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

6-2.1 Moratoriums. To the City Supplement, ADD the following:

Do not work in the areas where there is currently a moratorium issued by the City. The areas subject to moratorium are listed here:

- a) Shutdowns will not be allowed from June to October (inclusive).

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-3 LIABILITY INSURANCE. DELETE in its entirety and SUBSTITUTE with the following:

The insurance provisions herein must not be construed to limit your indemnity obligations contained in the Contract.

7-3.1 Policies and Procedures.

1. You must procure the insurance described below, at its sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.
2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.
3. You must maintain this insurance for the duration of this contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this contract. Your liabilities under the Contract, e.g., your indemnity obligations, is not deemed limited to the insurance coverage required by this contract.
4. Payment for insurance is included in the various items of Work as bid by you, and except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any work under this contract until you have provided and the City has approved all required insurance.
5. Policies of insurance must provide that the City is entitled to 30 days (10 days for cancellation due to non-payment of premium) prior written notice of cancellation

or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

7-3.2 Types of Insurance.

7-3.2.1 Commercial General Liability Insurance.

1. Commercial General Liability Insurance must be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.
2. The policy must cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured’s contract (including the tort liability of another assumed in a business contract).
3. There must be no endorsement or modification limiting the scope of coverage for either “insured vs. insured” claims or contractual liability. You must maintain the same or equivalent insurance for at least 10 years following completion of the Work.
4. All costs of defense must be outside the policy limits. Policy coverage must be in liability limits of not less than the following:

<u>General Annual Aggregate Limit</u>	<u>Limits of Liability</u>
Other than Products/Completed Operations	\$2,000,000
Products/Completed Operations Aggregate Limit	\$2,000,000
Personal Injury Limit	\$1,000,000
Each Occurrence	\$1,000,000

7-3.2.2 Commercial Automobile Liability Insurance.

1. You must provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of \$1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles (“Any Auto”).
2. All costs of defense must be outside the limits of the policy.

7-3.2.3 Contractors Pollution Liability Insurance.

1. You must procure and maintain at your expense or require Subcontractor, as described below to procure and maintain, the Contractors Pollution Liability Insurance including contractual liability coverage to cover liability arising out of cleanup, removal, storage, or handling of hazardous or toxic chemicals,

materials, substances, or any other pollutants by you or any Subcontractor in an amount not less than \$2,000,000 limit for bodily injury and property damage.

2. All costs of defense must be outside the limits of the policy. Any such insurance provided by Subcontractor instead of you must be approved separately in writing by the City.
3. For approval of a substitution of Subcontractor's insurance, you must certify that all activities for which the Contractors Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance. The deductible must not exceed \$25,000 per claim.
4. Contractual liability must include coverage of tort liability of another party to pay for bodily injury or property damage to a third person or organization. There must be no endorsement or modification of the coverage limiting the scope of coverage for either "insured vs. insured" claims or contractual liability.
5. Occurrence based policies must be procured before the Work commences and must be maintained for the Contract Time. Claims Made policies must be procured before the Work commences, must be maintained for the Contract Time, and must include a 12 month extended Claims Discovery Period applicable to this contract or the existing policy or policies must continue to be maintained for 12 months after the completion of the Work without advancing the retroactive date.
6. Except as provided for under California law, the policy or policies must provide that the City is entitled to 30 days prior written notice (10 days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.3 Rating Requirements. Except for the State Compensation Insurance Fund, all insurance required by this contract as described herein must be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

7-3.3.1 Non-Admitted Carriers. The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers must be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

7-3.4 Evidence of Insurance. Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document must be signed by the insurer or a person authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

7-3.5 Policy Endorsements.

7-3.5.1 Commercial General Liability Insurance

7-3.5.1.1 Additional Insured.

- a) You must provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.
- b) To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy must be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.
- c) The additional insured coverage for projects for which the Engineer's Estimate is \$1,000,000 or more must include liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) your products, (c) your work, e.g., your completed operations performed by you or on your behalf, or (d) premises owned, leased, controlled, or used by you.
- d) The additional insured coverage for projects for which the Engineer's Estimate is less than \$1,000,000 must include liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) your products, or (c) premises owned, leased, controlled, or used by you.

7-3.5.1.2 Primary and Non-Contributory Coverage. The policy must be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it must provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives must be in excess of your insurance and must not contribute to it.

7-3.5.1.3 Project General Aggregate Limit.

The policy or policies must be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work must reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit must be in addition to the aggregate limit provided for the products-completed operations hazard.

7-3.5.2 Commercial Automobile Liability Insurance.

7-3.5.2.1 Additional Insured. Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy must be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This

endorsement is limited to the obligations permitted by California Insurance Code §11580.04.

7-3.5.3 Contractors Pollution Liability Insurance Endorsements.

7-3.5.3.1 Additional Insured.

- a) The policy or policies must be endorsed to include as an Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) your products, (c) your work, e.g., your completed operations performed by you or on your behalf, or (d) premises owned, leased, controlled, or used by you; except that in connection with, collateral to, or affecting any construction contract to which the provisions of subdivision (b) of § 2782 of the California Civil Code apply, this endorsement must not provide any duty of indemnity coverage for the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives in any case where an agreement to indemnify the City and its respective elected officials, officers, employees, agents, and representatives would be invalid under subdivision (b) of §2782 of the California Civil Code.
- b) In any case where a claim or loss encompasses the negligence of the Insured and the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives that is not covered because of California Insurance Code §11580.04, the insurer's obligation to the City and its respective elected officials, officers, employees, agents, and representatives must be limited to obligations permitted by California Insurance Code §11580.04.

7-3.5.3.2 Primary and Non-Contributory Coverage. The policy or policies must be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives must be in excess of your insurance and must not contribute to it.

7-3.5.3.3 Severability of Interest. For Contractors Pollution Liability Insurance, the policy or policies must provide that your insurance must apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability and must provide cross-liability coverage.

7-3.6 Deductibles and Self-Insured Retentions. You must pay for all deductibles and self-insured retentions. You must disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.

7-3.7 Reservation of Rights. The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer but not required by this contract.

7-3.8 **Notice of Changes to Insurance.** You must notify the City 30 days prior to any material change to the policies of insurance provided under this contract.

7-3.9 **Excess Insurance.** Policies providing excess coverage must follow the form of the primary policy or policies e.g., all endorsements.

7-4 **WORKERS' COMPENSATION INSURANCE.** DELETE in its entirety and SUBSTITUTE with the following:

7-4.1 **Workers' Compensation Insurance and Employers Liability Insurance.**

1. In accordance with the provisions of §3700 of the California Labor Code, you must provide at your expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.

2. Limits for this insurance must be not less than the following:

<u>Workers' Compensation</u>	<u>Statutory Employers Liability</u>
Bodily Injury by Accident	\$1,000,000 each accident
Bodily Injury by Disease	\$1,000,000 each employee
Bodily Injury by Disease	\$1,000,000 policy limit

3. By signing and returning the Contract you certify that you are aware of the provisions of §3700 of the Labor Code which require every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code and you must comply with such provisions before commencing the Work as required by §1861 of the California Labor Code.

7-4.1.1 **Waiver of Subrogation.**

The policy or policies must be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from work performed by the Named Insured for the City.

7-8.6 **Water Pollution Control.** ADD the following:

1. Based on a preliminary assessment by the City, the Contract is subject to WPCP.

7-10.5.3 **Steel Plate Covers.** Table 7-10.5.3(A), REVISE the plate thickness for 5'-3" trench width to read 1 3/4".

7-15 **INDEMNIFICATION AND HOLD HARMLESS AGREEMENT.** To the City Supplement, fourth paragraph, last sentence, DELETE in its entirety and SUBSTITUTE with the following:

Your duty to indemnify and hold harmless does not include any claims or liability arising from the established active or sole negligence, or willful misconduct of the City, its officers, or employees.

7-16 **COMMUNITY LIAISON.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

ADD:

7-16 **COMMUNITY OUTREACH.**

7-16.1 **General.**

1. To ensure consistency with the City's community outreach plan for the project, the City will work with you to inform the public (which includes, but is not limited to, property owners, renters, homeowners, business owners, recreational users, and other community members and stakeholders) of construction impacts. Efforts by you to mitigate construction impacts by communicating with the public require close coordination and cooperation with the City.
2. You shall perform the community outreach activities required throughout the Contract Time. You shall assign a staff member who will perform the required community outreach services.
3. You shall closely coordinate the Work with the businesses, institutions, residents and property owners impacted by the Project.

Your example duties include notifying businesses, institutions, and residents of the commencement of construction activities not less than 5 days in advance, coordinating access for vehicular and pedestrian traffic to businesses, institutions, and residences impacted by the Project, reporting activities at all Project progress meetings scheduled by the Engineer, attending the Project Pre-construction Meeting, attending 2 community meetings, responding to community questions and complaints related to your activities, and documenting, in writing, as well as logging in all inquiries and complaints received into the City's Public Contact Log located on the City's SDSshare site:

<http://sdshare/forums/ecp/PITS/picr/Lists/Public%20Contact%20Log/AllItems.aspx>

4. You shall execute the Information Security Policy Acknowledgement Form - For Non-City Employees within 15 days of the award of the Contract if:
 - a) Your contact information is made available on any outreach materials or;
 - b) You will be the primary point of contact to resolve project related inquiries and complaints.

5. **Electronic Communication.**

All inquiries and complaints will be logged in to the City's SDSHare site within 24 hours of receipt of inquiries and complaints.

Any updates or a resolution of inquiries, and complaints shall be documented in the City's SDSHare site within 24 hours.

Copies of email communications shall be saved, individually, on to the City's SDSHare site as an Outlook Message Format (*.msg).

All graphics, photos, and other electronic files associated with the inquiries and or complaints shall be saved into the individual record.

7-16.1.1 Quality Assurance.

1. During the course of community outreach, you shall ensure that the character of all persons that conduct community outreach (distributing door hangers, attending community meetings, interacting with the public, etc.) on your behalf shall:
 - a. Have the ability to speak and comprehend English and/or Spanish, as appropriate for the community or public they are informing,
 - b. Possess and display easily verifiable and readable personal identification that identifies the person as your employee,
 - c. Have the interpersonal skills to effectively, professionally, and tactfully represent you, the project, and the City to the public.

7-16.1.2 Submittals.

1. You shall submit to the Resident Engineer, for review and approval, all drafts of letters, notices, postcards, door hangers, signs, mailing lists, proposed addresses for hand-delivery, and any other notices and letters that are to be mailed and or distributed to the public.
 - a. Prior to distributing or mailing, you shall submit final drafts of letters, notices, postcards, door hangers, signs, and any other notices and letters to the Resident Engineer for final review and approval. Submit a PDF copy of the approved door hangers to the Engineer.
 - b. After distributing or mailing, you shall submit verification of delivery and any copies of returned notices to the Resident Engineer. Submit a PDF copy of the approved letters and notices to the Engineer.
2. You shall use the City's SDSHare site to identify and summarize communications (via phone, in person, and email) with the public within 24 hours of receipt, even if your response to the individual is still incomplete.

You shall upload to the City's SDSShare site copies of all written, electronic, and verbal communications and conversations with the public.

7-16.2 Community Outreach Services.

7-16.2.1 Public Notice by Contractor.

1. Post Project Identification Signs in accordance with section 7-10.6.2
2. Notify businesses, institutions, property owners, residents or any other impacted stakeholders, within a minimum 300 feet radius of the Project, of construction activities and utility service interruptions not less than 5 days in advance.
3. Furnish and distribute public notices in the form of door hangers using the City's format to all occupants and/or property owners along streets:
 - a. Where Work is to be performed at least 5 days before starting construction or survey activities or impacting the community as approved by the Resident Engineer.
 - b. Within 5 days of the completion of your construction activities where work was performed, you shall distribute public notices in the form of door hangers, which outlines the anticipated dates of Asphalt Resurfacing or Slurry Seal.
 - c. No less than 48 hours in advance and no more than 72 hours in advance of the scheduled resurfacing.
4. Leave the door hanger notices on or at the front door of each dwelling and apartment unit and at each tenant of commercial buildings abutting each of the street block segments. Where the front doors of apartment units are inaccessible, distribute the door hanger notices to the apartment manager or security officer.
5. Door Hanger Material: You shall use Blanks/USA brand, Item Number DHJ5B6WH, 1 1/4" Holes (removed), 2-up Jumbo Door Hanger in Bristol White, or approved equal.
6. Mailed Notice Material: You shall use Cougar by Domtar, Item Number 2834 or approved equal.
7. For all Work on private property, contact each owner and occupant individually a minimum of 15 days prior to the Work. If the Work has been delayed, re-notify owners and occupants of the new Work schedule, as directed by the Resident Engineer.
8. A sample of public notices is included in the Contract Appendix.

7-16.2.2 Communications with the Public.

1. Coordinate access for vehicular and pedestrian traffic to businesses, institutions and residences impacted by the Project.
2. You shall provide updates on construction impacts to the Resident Engineer. You shall notify the Resident Engineer in advance about time-sensitive construction impacts and may be required to distribute construction impact notices to the public on short notice.
3. You shall incorporate community outreach activities related to construction impacts in the baseline schedule and update the Resident Engineer with each week's submittal of the Three-Week Look Ahead Schedule.
4. At the request of the Resident Engineer, you shall attend and participate in project briefings at community meetings.
5. You shall coordinate with the Resident Engineer on all responses and actions taken to address public inquiries and complaints within 24-hours that they are received.

7-16.2.3 Communications with Media.

1. The City may allow members of the media access to its construction site(s) on a case-by-case basis only.
2. Occasionally, members of the media may show up at construction sites, uninvited. Members of the media (including, but not limited to newspaper, magazine, radio, television, bloggers, and videographers) do not have the legal right to be in the construction site without the City's permission.
3. In the event media representatives arrive near or on the construction site(s), you shall keep them off the site(s), in a courteous and professional manner, until a Public Information Officer is available to meet them at an approved location.
4. You shall report all members of the media visits to the Resident Engineer as quickly as possible, so that the City's Public Information Officer can meet with the members of the media at the construction site(s).
5. If the City allows members of the media to access a construction site, you shall allow the City to escort the media representatives while they are on the construction site and shall ensure their safety.
6. You shall require media representatives to sign in and out of the Site Visitor Log and to use Personal Protective Equipment.
7. You have a right to speak to members of the media about your company and its role on the project. All other questions shall be referred to the City.

7-16.4 Payment. The Payment for the Community Outreach Service is included in the various Bid items.

SECTION 9 - MEASUREMENT AND PAYMENT

9-3.2.5 Withholding of Payment. To the City Supplement, item i), DELETE in its entirety and SUBSTITUTE with the following:

- i) Your failure to comply with 7-2.3, "PAYROLL RECORDS" and 2-16, "CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM."

SECTION 300 – EARTHWORK

300-1.4 Payment. To the City Supplement, paragraph (2), DELETE in its entirety and SUBSTITUTE with the following:

- 2. Payment for existing pavement removal and disposal of up to 12" thick, within the excavation e.g., trench limits, shall be included in the Bid item for installation of the mains or the Work item that requires pavement removal.

SECTION 306 – UNDERGROUND CONDUIT CONSTRUCTION

306-1 OPEN TRENCH OPERATIONS. To the City Supplement, CORRECT certain section numbering as follows:

OLD SECTION NUMBER	TITLE	NEW SECTION NUMBER
306-1.8	House Connection Sewer (Laterals) and Cleanouts	306-1.9
306-1.7.1	Payment	306-1.9.1
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306-1.6 Basis of Payment for Open Trench Installations. ADD the following:

Payment for imported backfill when the Contractor elects to import material from a source outside the project limits and when authorized by the Engineer shall be

included in the Bid unit price for Imported Backfill. The price shall include the removal and disposal of unsuitable materials.

306-1.8.3 Polyurethane Lining. To the City Supplement, item 5, DELETE in its entirety.

SECTION 707 – RESOURCE DISCOVERIES

ADD:

707-1.1 Environmental Document. The City of San Diego Environmental Analysis Section (EAS) of the Development Services Department has prepared CEQA EXEMPTION for **SBWRP SLUDGE PUMP AND GRINDER**, DEP No. **B141670**, as referenced in the Contract Appendix. You must comply with all requirements of the CEQA EXEMPTION as set forth in the Contract **Appendix A**.

Compliance with the City’s environmental document is included in the various Bid items, unless a bid item has been provided.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

TECHNICALS

City of San Diego

100% SUBMITTAL CONTRACT DOCUMENTS for



South Bay Water Reclamation Plant – Sludge Pump and Grinder Installation

VOLUME 01

MASTER TECHNICAL SPECIFICATIONS – DIVISIONS 01 THROUGH 16

SPECIFICATION NO. 1374

WBS NO. B-14167

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VOLUME II – Contract Drawings

VOLUME III – Reference Documents

1. Moyno Pump and Grinder O&M manual.
2. South Bay WRP As-Built drawing may be available in electronic format from the City at an additional cost on request.

**** END OF TABLE OF CONTENTS ****

SECTION 02050 - DEMOLITION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes furnishing materials, equipment and labor necessary to perform and complete demolition per Contract Documents.
- B. In areas indicated to be remodeled, cut back flush and seal any pipe stub-outs remaining, and remove exposed piping, conduits, fixtures, junction boxes, light fixtures, water fixtures, and supports. Switches, receptacles, and boxes shall also be removed. Concealed piping and conduits shall be removed or capped and abandoned as necessary to facilitate the remodeling work. All other items shall be removed as shown.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 02200 Earthwork
 - 2. Section 13300 Instrumentation and Control

1.3 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. Uniform Building Code

1.5 SUBMITTALS

- A. The following shall be submitted:
 - 1. Demolition Schedule: The CONTRACTOR shall submit a complete coordination schedule for demolition work including shut-off and continuation of utility services prior to start of the WORK. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

1.6 ASBESTOS REMOVAL

- A. The OWNER is responsible for the removal and disposal of any asbestos found in structures scheduled for demolition, prior to commencement of demolition work by the CONTRACTOR.

- B. If, during demolition work, any additional asbestos materials are being discovered, the CONTRACTOR shall stop the work immediately and notify the CONSTRUCTION MANAGER for further instructions.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 GENERAL

- A. Structures shall be demolished and removed in compliance with SSPWC subsection 306-5 and the requirements indicated herein.

3.2 POLLUTION CONTROL

- A. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used for dust suppression.
- B. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.3 PROTECTION

- A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities.
- B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.
- C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary.
- D. Unless otherwise indicated, the CONTRACTOR shall protect and maintain all utilities in the proximity of the facilities to be demolished.
- E. The CONTRACTOR shall protect the nearby existing equipment such as control panels and others from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.4 STRUCTURE DEMOLITION

- A. Building structures and appurtenances shall be demolished, as shown and required to complete work, in compliance with governing regulations.
- B. Small structures may be removed intact when approved by authorities having jurisdiction.
- C. Demolition shall proceed in a systematic manner, from top of structure to ground.
- D. Concrete and masonry shall be demolished in small sections. Use bracing and shoring to prevent collapse.

- E. Demolition equipment shall be dispersed throughout structure and demolished materials removed to prevent excessive loads on supporting walls, floors or framing.

3.5 BELOW-GRADE DEMOLITION

- A. Footings, foundation walls, below-grade construction and concrete slabs on grade shall be demolished and removed to a depth which will not interfere with new construction, but not less than 12 inches below existing ground surface or future ground surface, whichever is lower. All floors of basements, vaults, and other underground structures shall be broken up.
- B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum compaction of 95%.
- C. All fill and compaction shall be in accordance with Section 02200.
- D. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the OWNER. Alternate routes shall be provided around closed or obstructed traffic ways.
- B. Site debris, rubbish, and other materials resulting from demolition operations shall be removed and disposed of in compliance all laws and regulations. Burning of removed materials from demolished structures shall not be permitted.

3.7 PATCHING AND REPAIRING

- A. The CONTRACTOR shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent surfaces.
- B. The CONTRACTOR shall repair all damages caused to adjacent facilities by demolition at no additional cost to the OWNER.
- C. After patching and repairing has been completed, the CONTRACTOR shall carefully remove splatterings of mortar from adjoining work (plumbing fixtures, trim, tile, and finished metal surfaces) and repair any damage caused by such cleaning operations.

3.8 CLEANING

- A. During and upon completion of work, the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a clean condition.
- B. Clean adjacent structures and facilities of dust, dirt, and debris caused by demolition and return adjacent areas to condition existing prior to start of work.
- C. The CONTRACTOR shall clean and sweep the affected portions of roads, streets, sidewalks and passageways daily.

** END OF SECTION **

SECTION 02100 - SITE PREPARATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes site preparation, clearing and grubbing.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 02050 Demolition
 - 2. Section 02200 Earthwork

1.3 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 GENERAL

- A. **Existing Conditions:** The site shall be examined and the CONSTRUCTION MANAGER notified of any conditions which affect the WORK of this Section.
- B. **Utility Interference:** Where existing utilities interfere with the WORK of this Section, the CONSTRUCTION MANAGER shall be notified of interferences.

3.2 CLEARING AND GRUBBING

- A. Clearing and grubbing shall comply with SSPWC Subsection 300-1 and the following:
 - 1. The site shall be cleared of grass and weeds to a depth of at least 6 inches and debris and obstructions including brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger than 6 inches in any dimension, broken or old concrete and pavement.

2. The site shall be grubbed to a depth necessary to remove objectionable material including stumps and roots.

3.3 SALVAGE AND DISPOSAL

- A. **Salvage:** Topsoil shall be salvaged and stored at a location which will not interfere with the WORK.
- B. **Disposal:** Waste material shall be disposed of in accordance with SSPWC Subsection 300-1.3.

** END OF SECTION **

SECTION 02200 - EARTHWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the WORK.
- B. Fill material is defined as material used to raise the level of a portion of the site to the line and grade indicated. Backfill material is defined as material used to refill an excavation.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

- 1. Section 02100 Site Preparation

1.3 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 REGULATORY REQUIREMENTS

- A. The WORK of this Section shall comply with current versions, with revisions, of the following:
 - 1. Construction Safety Orders, Division of Industrial Safety, State of California.
 - 2. California Department of Transportation Traffic Manual.

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. The CONTRACTOR shall comply with the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the OWNER and shall be in possession of the OWNER's written acceptance of the CONTRACTOR's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared by a civil or structural engineer licensed in the State of California.
 - 2. Copy of the excavation permit issued by the California Department of Industrial Safety.

3. Samples of imported material. Samples shall be submitted in accordance with SSPWC, Subsection 306-1.3.5.
4. Such other samples of materials as the CONSTRUCTION MANAGER may require.

1.6 SOIL TESTING

- A. **General:** All soils testing shall be done in accordance with SSPWC, Section 211, and by a testing laboratory of the OWNER's choice at the OWNER's expense.
- B. **Compaction Tests:** Where soil material is required to be compacted to a percentage of maximum density, the maximum density shall be determined in accordance with the requirements of SSPWC, Subsection 211-2. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and shall be at the CONTRACTOR's expense.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

- A. **General:** Fill and backfill material shall consist of select material obtained from the excavation, imported material, granular bedding material, or unclassified material. The CONTRACTOR shall import at his expense materials in excess of the approved material obtained from excavation as required to complete the fill, backfill, and grading WORK as indicated.
- B. **Select Material:** Select material shall consist of primarily granular material encountered in the excavation which is free of vegetation, organic matter, debris, rocks larger than 4 inches in diameter and other unsuitable material, and shall have an expansion index less than 30 (less than 20 for footings and floor slabs) as determined by UBC Standard No. 29-2, plasticity index of 10 or less, a liquid limit of 30 or less and shall be approved as select material by the CONSTRUCTION MANAGER.
- C. **Imported Material:** Imported material shall conform to the same specifications as select material defined above. In addition, the imported materials shall have a minimum sand equivalent of 15 as determined by California Test Method No. 217. Imported material placed in areas to be planted shall be able to support normal plant growth. Obtain approval by the CONSTRUCTION MANAGER prior to transporting imported material.
- D. **Bedding Material:** Bedding material, defined as that material supporting, surrounding and extending to 1 foot above the top of a pipe, shall be in accordance with SSPWC, Subsection 306-1.2.1.
- E. **Unclassified Material:** Unclassified material shall conform to SSPWC, Subsection 300-4.

2.2 ROCK PRODUCTS

- A. Rock products, consisting of crushed rock, rock dust, gravel, sand, and stone for riprap shall be clean, hard, sound, durable, uniform in quality and free of disintegrated material, organic matter, oil alkali, or other deleterious substance, and shall, unless otherwise specified, conform with the requirements of SSPWC, Subsection 200-1.

2.3 UNTREATED BASE MATERIALS

- A. Untreated base materials shall conform with the requirements of SSPWC, Subsection 200-2.

2.4 TOPSOIL

- A. Topsoil shall be designated as Class A (imported), Class B (selected), or Class C (unclassified), and shall conform with the requirements of SSPWC, Subsection 212-1.1. The CONSTRUCTION MANAGER shall determine the suitability of topsoil prior to use.

PART 3 -- EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall perform earthwork as necessary to complete the WORK as shown on the Contract Drawings and specified herein. The CONTRACTOR shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of his activities. The necessary precautionary measures shall conform to the requirements of SSPWC, Subsection 7-8. The requirements specified in Subsection 7-8 shall be extended to include paved surfaces.
- B. All types of earthwork, including trench, structural and general excavation, fill, backfill and compaction, shall conform to applicable requirements of the SSPWC. Section 300, and to the requirements specified herein.

3.2 SITE PREPARATION

- A. Areas to be excavated, filled, graded, and to be occupied by permanent construction or embankments shall be prepared by clearing and grubbing. Clearing and grubbing shall conform to the applicable requirements of SSPWC, Subsection 300-1.

3.3 EXCAVATION

- A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed, the removal of said materials shall conform to the lines and grades shown. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of the Division of Industrial Safety of the State of California.
- B. **Unclassified Excavation:** Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.
 1. Unsuitable material shall be excavated and disposed of in accordance with the requirements of SSPWC, Subsection 300-2.2.
 2. Wet material, if unsatisfactory for the specified use on the project solely because of high

moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material in accordance with the requirements of SSPWC, Subsection 300-2.2.2.

3. The removal and disposal of slide and slipout material shall be in accordance with SSPWC, Subsection 300-2.4.
4. Excavation slopes shall be finished in conformance with the lines and grades shown, and in accordance with SSPWC, Subsection 300-2.5.
5. Surplus material shall be disposed of off-site, and in accordance with SSPWC, Subsection 300-2.6.

C. Structure Excavation: Structure excavation shall consist of the removal of material for the construction of foundations for bridges, retaining walls, headwalls, culverts, buildings, or other structures, and shall be in accordance with SSPWC, Subsection 300-3.

1. Cofferdams for foundation construction shall be constructed in accordance with SSPWC, Subsection 300-3.2.
2. The treatment of foundation material shall be in accordance with SSPWC, Subsection 300-3.3.

D. Underground Conduit Excavation:

1. **General:** Excavation for underground conduits shall be in accordance with SSPWC, Subsection 306-1.1 and the requirements contained herein. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches for mechanical compaction methods and 18 inches for water consolidation methods. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and larger and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches.
2. **Bracing Excavations:** The manner of bracing excavations shall be as set forth in the rules, orders and regulations of the Division of Industrial Safety of the State of California, and in accordance with the requirements of SSPWC, Subsection 306-1.1.6.
3. **Trench Bottom:** Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.
4. **Open Trench:** The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights conforming to requirements set forth in the California Department of Transportation Traffic Manual shall be provided and maintained.

5. Trench Over-Excavation: Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth required, and then backfilled to the grade of the bottom of the pipe.
6. Where pipelines are to be installed in embankment fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

E. Over-Excavation Ordered by CONSTRUCTION MANAGER:

1. Trenches shall be over-excavated beyond the depth shown when required by the CONSTRUCTION MANAGER. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the CONTRACTOR at no additional cost to the OWNER when the over-excavation ordered by the CONSTRUCTION MANAGER is less than 6 inches below the limits shown. When the over-excavation ordered by the CONSTRUCTION MANAGER is 6 inches or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the work which is located below said 6-inch distance.

F. Over-Excavation not Ordered or Indicated:

1. Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with the specified material and compacted. Such work shall be performed by the CONTRACTOR at no additional cost to OWNER.

G. Excavation in Lawn Areas: N/A

H. Excavation in Vicinity of Trees: N/A

I. Rock Excavation:

1. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.
2. Said rock excavation shall be performed by the CONTRACTOR; provided that should the quantity of rock excavation be affected by any change in the scope of the WORK, an appropriate adjustment of the contract price will be made.

3.4 FILL AND BACKFILL

A. General:

1. Fill and Backfill shall be placed in accordance with the applicable provisions of SSPWC, Section 300, and the requirements stated herein.
2. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has been properly cured in accordance with the requirements of Section 03300 and has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill

is being placed.

3. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall not be placed until all water is removed from the excavation.

B. Placing and Spreading of Materials:

1. Materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted, each layer shall not exceed 8 inches in thickness. When compaction is achieved using flooding and jetting methods, each layer shall not exceed 3 feet in thickness after compaction.
2. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Bedding materials shall be brought up evenly around the pipe so that when compacted, the material will provide uniform bearing and side support.
3. Where the material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.
4. Where the material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

C. Compaction Requirements

1. Compaction tests shall be performed in accordance with SSPWC, Subsection 211-2.
2. The relative compaction of fill, backfill, and base material shall be in accordance with SSPWC, Section 300, with the following exceptions:
 - a. Subgrade where trench has been overexcavated: 95%
 - b. One foot layer of crushed aggregate backfill in overexcavated trench. Where trench is overexcavated more than 2 feet, minimum of 2 layers shall be compacted. 95%
 - c. Pipe zone for flexible and rigid pipe : 95%
 - d. Fill beneath structures, including water containing structures: 95%
 - e. Backfill on underground structure roof: 90%

D. Unclassified Fill:

1. All fill shall be of unclassified material unless separately designated. Construction of unclassified fill, including preparing the area on which fill is to be placed, and the depositing, conditioning, and compacting of fill material shall be in accordance with SSPWC, Subsection 300-4.

E. Structure Backfill:

1. Backfill at structure shall be placed in accordance with SSPWC, Subsections 300-3.5 and 300-4.5.

F. Underground Conduit Backfill:

1. Bedding around pipe shall be bedding material placed in accordance with the requirements of SSPWC, Subsection 306-1.2.
2. Backfill above shall be considered as starting 1 foot above the pipe or conduit, or at the subgrade for cast-in-place structures such as manholes, transition structures, junction structures, vaults, and valve boxes.
3. Backfill at underground conduits shall be placed and densified according to SSPWC, Subsection 306-1.3.

3.5 PREPARATION OF SUBGRADE UNDER IMPROVEMENT

- A. The preparation of subgrade for pavement, curbs and gutters, driveways, sidewalks and other roadway structures shall be in accordance with SSPWC, Subsection 301-1.

3.6 UNTREATED BASE

A. Spreading and Compacting:

1. Aggregate base material shall be spread and compacted in accordance with SSPWC, Subsection 301-2.

**** END OF SECTION ****

SECTION 02575 - PAVEMENT REHABILITATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes removal and rehabilitation of pavement affected by CONTRACTOR'S operations such as trenching, modification to facilities or as otherwise indicated.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

- 1. Section 02200 Earthwork

1.3 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 PROJECT RECORD DRAWINGS

- A. The following shall be included in the PROJECT RECORD DRAWINGS in compliance with the General Requirement:
 - 1. Drawings indicating the exact extent of pavement removed and rehabilitated.

PART 2 -- PRODUCTS

2.1 ASPHALT CONCRETE

- A. Asphalt concrete shall conform to the requirements of SSPWC subsection 203-6. Composition and grading of the asphalt concrete mixture shall conform to SSPWC subsection 203-6.4.3, class F.
- B. Tack coat shall comply with subsection 302-5.4 of SSPWC.

2.2 PORTLAND CEMENT CONCRETE

- A. Portland cement concrete shall comply with the requirements of subsection 201-1 of SSPWC; class 560-C-3250 per subsection 201-1.1.2 of SSPWC.
- B. Curing compound for concrete that is to be topped by an asphaltic wearing course shall comply with SSPWC subsection 201-4 and shall be asphaltic type. Pigmentation is not required.

PART 3 -- EXECUTION

3.1 REMOVAL OF PAVEMENT

- A. Existing AC pavement shall be sawcut to a minimum depth of 1-1/2 inches or 25 percent of its thickness, whichever is greater.
- B. Removal of the existing cement concrete pavement for trench excavation shall be done in accordance with subsection 300-1.3 of SSPWC.

3.2 PLACEMENT OF PORTLAND CEMENT CONCRETE PAVEMENT

- A. Subgrade preparation shall be done in accordance with subsection 301-1 of the SSPWC.
- B. Prior to placing concrete, pavement edges shall be trimmed to neat horizontal and vertical lines. In case of AC pavement, a tack coat shall be applied to the existing pavement prior to placing cement concrete; while in the case of concrete pavement, the surface of edges shall be thoroughly wetted with water.
- C. Portland cement concrete pavement shall be reconstructed in accordance with the applicable provisions of SSPWC subsection 302-6.

3.3 PLACEMENT OF WEARING SURFACE COURSE FOR AC PAVEMENT

- A. In the case of rehabilitation of AC pavement, use only asphaltic type concrete curing compound.
- B. Apply tack coat, to cement concrete pavement surface after it has cured, in accordance with SSPWC subsection 302-5.4.
- C. Install asphaltic concrete, Class F, wearing course in accordance with the applicable provisions of SSPWC subsection 302-5.

**** END OF SECTION ****

SECTION 03200 - REINFORCEMENT STEEL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction, including all the wires, clips, supports, chairs, spacers, and other accessories.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

- 1. Section 03300 Cast-in-Place Structural Concrete

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

- 1. California Building Code, the latest edition

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Structural Concrete.
ACI 350	Code Requirements for Environmental Engineering Concrete Structures.
CRSI MSP-1	Concrete Reinforcing Steel Institute Manual of Standard Practice.
WRI	Manual of Standard Practice for Welded Wire Fabric.
AWS D1.4	Structural Welding Code - Reinforcing Steel.
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A 185	Specification for Welded Steel Wire Fabric For Concrete Reinforcement.
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars.

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. Shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.
- B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the CONTRACTOR at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements indicated. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.
- C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, manufacturer's literature shall be submitted which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.
- D. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The CONTRACTOR shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.
- E. Mill certificates shall be delivered with each shipment of reinforcing bars.

1.6 FACTORY TESTING

- A. If requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests and sample materials will be paid by the OWNER. Costs of additional tests due to material failing initial tests shall be paid by the CONTRACTOR.
- B. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

1.7 FIELD TESTING

- A. Products shall be field tested for compliance with the indicated requirements. If requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the CONSTRUCTION MANAGER, radiographic testing of direct butt welded splices will be performed. The CONTRACTOR shall provide assistance necessary to facilitate testing. The CONTRACTOR shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the OWNER; except, the

costs of all tests which fail to meet specified requirements shall be paid by the CONTRACTOR at no additional cost to the OWNER.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Materials specified in this Section which may remain or leave residues on or within the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 REINFORCEMENT STEEL

- A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise indicated.
2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and as indicated; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.
3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

- B. **Accessories:**

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.
3. Tie wire shall be a minimum 14 gauge annealed steel wire.

- C. Epoxy coating for reinforcing and accessories, where specified or shown, shall conform to ASTM A 775, but its usage shall be subject to City approval.

2.3 MECHANICAL COUPLERS

- A. Mechanical couplers shall be provided where shown and where approved by the CONSTRUCTION MANAGER. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.
- B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.
- C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

2.4 WELDED SPLICES

- A. Welded splices shall be provided where shown and where approved by the CONSTRUCTION MANAGER. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.
- B. Welded splices shall conform to the requirements of AWS D1.4.

2.5 EPOXY GROUT

- A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315.

2.6 MANUFACTURERS

- A. Products of the type indicated, shall be manufactured by one of the following (or equal):

- 1. **Couplers:**

- Lenton Form Saver by Erico Products
 - Dowel Bar Splicer System by Dayton Superior.

PART 3 -- EXECUTION

3.1 GENERAL

- A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.2 FABRICATION

A. **General:**

1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as indicated. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2-inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2-inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.
2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1 inch
2. Depth of truss bars: $+ 0, - 1/2$ inch
3. Stirrups, ties, and spirals: $\pm 1/2$ inch
4. All other bends: ± 1 inch

3.3 PLACING

A. Reinforcement steel shall be accurately positioned and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows.

1. **Concrete Dobies:** Permitted at all locations except where architectural finish is required.
2. **Wire Bar Supports:** Permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.
3. **Plastic Bar Supports:** Permitted at all locations except on grade.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

- D. Bars additional to those shown which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at no additional cost to the OWNER.
- E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the CBC.
- F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to the approval of the CONSTRUCTION MANAGER.
- G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.
- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.
- I. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Non-abrasive slings made of nylon and similar materials shall be used. Specially coated bar supports shall be used. All chips or cracks in the epoxy coating shall be repaired with a compatible epoxy repair material prior to placing concrete.
- J. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.
- B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one inch.
- C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.
- D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.5 SPLICING

- A. **General:**

1. Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the CONSTRUCTION MANAGER.

B. Splices of Reinforcement:

1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318.
2. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
3. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

C. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the CONSTRUCTION MANAGER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the CONSTRUCTION MANAGER.

D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

E. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.

F. Tack welding of reinforcing bars is prohibited.

3.6 CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Hole Preparation:

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.
2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.
6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.
7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

** END OF SECTION **

SECTION 03300 - CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing finished cast-in-place structural concrete including forming, mixing, placing, curing, repairing, and finishing.
- B. The following types of concrete shall be covered in this Section:
 - 1. **Structural Concrete:** Concrete to be used in all cases except where indicated otherwise.
 - 2. **Lean Concrete:** Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are indicated as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.
- C. The term "hydraulic structure" used in these specifications shall refer to environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 03200 Reinforcement Steel
 - 2. Section 03315 Grout

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
- B. **Federal Specifications:**
 - UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).
- C. **Commercial Standards:**
 - ACI 117 Standard Tolerances for Concrete Construction and Materials
 - ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete
 - ACI 301 Specifications for Structural Concrete for Buildings
 - ACI 309 Consolidation of Concrete

ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ASTM C 31	Practices for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 143	Test Method for Slump of Portland Cement Concrete
ASTM C 150	Specification for Portland Cement
ASTM C 157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C 172	Standard Method of Sampling Freshly Mixed Concrete
ASTM C 192	Method of Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 289	Test Method for Potential Reactivity of Aggregates (Chemical Method)
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Specification for Chemical Admixtures for Concrete
ASTM C 535	Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation
ASTM D 175	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E 119	Method for Fire Tests of Building Construction and Materials

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. **Mix Designs:** Prior to beginning the WORK and within 14 days of the notice to proceed, preliminary concrete mix designs which shall show the proportions and

gradations of all materials proposed for each class and type of concrete. The mix designs shall be checked by an independent testing laboratory acceptable to the CONSTRUCTION MANAGER. All costs related to such checking shall be borne by the CONTRACTOR.

2. Provide the following submittals in accordance with ACI-301:
 - a. Mill tests for cement.
 - b. Admixture certification. Chloride ion content must be included.
 - c. Aggregate gradation and certification.
 - d. Materials and methods for curing.

3. **Certified Delivery Tickets:** Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. CONTRACTOR'S certificate with each delivery ticket shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

1.5 TESTING

A. General

1. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
2. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the OWNER. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The laboratory must meet or exceed the requirements of ASTM C 1077.
3. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the OWNER, and the CONTRACTOR shall provide assistance to the CONSTRUCTION MANAGER in obtaining samples, and disposal and cleanup of excess material.

B. Field Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the CONSTRUCTION MANAGER to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.
2. Compression test specimens for concrete will be made and cured in accordance with ASTM C 31. Specimens will be 6-inch diameter by 12-inch high cylinders.

3. Compression tests will be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinder will be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5 "Concrete Quality," and as specified herein.
2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi.
3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the specified compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.
5. All concrete which fails to meet the ACI requirements and these specifications, is subject to removal and replacement at no additional cost to the OWNER.

D. Shrinkage Tests:

1. Drying shrinkage tests will be made for the trial batch indicated below, the first placement of each class of concrete, and during construction to insure continued compliance with these Specifications.
2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ± 1 hours after trial batching, shall be placed immediately in water at $70 \text{ degrees F} \pm 3 \text{ degrees F}$ for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at $73 \text{ degrees F} \pm 3 \text{ degrees F}$. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at $73 \text{ degrees F} \pm 3 \text{ degrees F}$ and 50 percent ± 4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated below.

E. **Construction Tolerances:** The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the plumb	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. **General:**

1. All materials specified herein shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application.
2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

- B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.
- D. Materials for concrete shall conform to the following requirements:
 - 1. Cement shall be standard brand Portland cement conforming to ASTM C 150 for Type II or Type V, including Table 1A optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the CONSTRUCTION MANAGER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the CONSTRUCTION MANAGER if requested regarding compliance with these Specifications.
 - 2. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
 - 3. Aggregates shall be obtained from pits acceptable to the CONSTRUCTION MANAGER, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified herein. Lightweight sand for fine aggregate will not be permitted.
 - a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete the two size groups shall be combined. See the requirements below for the use of the size groups.
 - b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.
 - c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

- d. When tested in accordance with ASTM C 289, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.
 - e. When tested in accordance with ASTM C 40, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.
 - f. When tested in accordance with ASTM C 131 or ASTM C 535, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.
 - g. When tested in accordance with ASTM C 88, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.
4. Ready-mix concrete shall conform to the requirements of ASTM C 94.
5. **Admixtures:** All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
- a. Air-entraining agent meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The OWNER reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement.
 - b. Set controlling and water reducing admixtures: Admixtures may be added at the CONTRACTOR's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the CONTRACTOR's expense. The use of an admixture shall be subject to acceptance by the CONSTRUCTION MANAGER. Concrete containing an admixture shall be first placed at a location determined by the CONSTRUCTION MANAGER. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.
 - (1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the CONSTRUCTION MANAGER.
 - (2) Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture shall be used.

- (3) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.
- (4) High range water reducer shall conform to ASTM C 494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.
- (5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches \pm 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.
- (6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.
- (7) Flyash shall not be used.

2.2 CURING MATERIALS

- A. Materials for curing concrete as specified herein shall conform to the following requirements and ASTM C 309:
 1. All curing compounds shall be white pigmented, resin based; Sodium silicate compounds shall not be allowed. Only water based resin curing compounds shall be used.
 2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.
 3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
 4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when

determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

5. Curing mats for use in Curing Method 6 as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.3 NON-WATERSTOP JOINT MATERIALS (NOT USED)

2.4 MISCELLANEOUS MATERIALS

- A. Dampproofing agent shall be an asphalt emulsion.
- B. Bonding agents shall be epoxy adhesives.

2.5 CONCRETE DESIGN REQUIREMENTS

- A. **General:** Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. In mix designs, the percentage of sand of the total weight of fine and coarse aggregate shall not exceed 41 for hydraulic structures or 50 for all other structures, unless noted otherwise. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the OWNER. All changes shall be subject to review by the CONSTRUCTION MANAGER.

Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Max W/C Ratio (by weight)
Structural Concrete:				
Roof, floor slabs, columns, walls and all other concrete items not specified elsewhere	4,000	1	611	0.45
12" and thicker walls, slabs on grade and footings. (optional)	4,000	1-1/2	611	0.45
Pea Gravel Mix. Thin sections and areas with congested reinforcing, at the CONTRACTOR'S option and with the written approval of the	4,000	3/8	752	0.40

Type of Work	Min 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Max W/C Ratio (by weight)
CONSTRUCTION MANAGER for the specific location. Maximum fine aggregate 50% by weight of aggregate.				
Lean concrete	2,000	1	376	0.60
Note: The CONTRACTOR is cautioned that the limiting parameters specified above are not a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the CONTRACTOR'S construction methods and aggregates. The CONTRACTOR is responsible for any costs associated with furnishing concrete with the required workability.				

- B. **Adjustments to Mix Design:** The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the CONTRACTOR shall be entitled to no additional compensation because of such changes.
- D. **Quick Set Concrete Mix:** Due to the limitation of pumping the ready mix concrete, quick set concrete mix package can be replaced with ready mix concrete. The products shall be the following, or approved equal: Quikrete 5000 Concrete Mix by Quikrete, Rapidset Concrete Mix by RapidSet. The mixing, curing, and finishing shall be in accordance with manufacturer's installation instructions.

2.6 CONSISTENCY

- A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (in)
All concrete, unless noted otherwise	3 inches +/- 1 inch
With high range water reducer added	7 inches +/- 2 inches
Pea gravel mix	7 inches +/- 2 inches
Ductbanks	5 inches +/- 1 inch

2.7 TRIAL BATCH AND LABORATORY TESTS

- A. Before placing any concrete, a testing laboratory designated by the CONSTRUCTION MANAGER shall prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the

aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch. The cost of not more than 3 laboratory trial batch tests for each specified concrete strength will be borne by the OWNER but the CONTRACTOR shall furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed at the expense of the CONTRACTOR at no increase in cost to the OWNER.

- B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.
- C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.8 SHRINKAGE LIMITATION

- A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.
- B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.
- C. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions, at no additional cost to the OWNER, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.9 MEASUREMENT OF CEMENT AND AGGREGATE

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the CONSTRUCTION MANAGER.
- B. **Weighing tolerances:**

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

2.10 MEASUREMENT OF WATER

- A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the CONSTRUCTION MANAGER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.11 READY-MIXED CONCRETE

- A. At the CONTRACTOR'S option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the following supplementary requirements.
- B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.
- C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
- E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

- F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the CONSTRUCTION MANAGER.
- G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the CONSTRUCTION MANAGER.

2.12 MANUFACTURERS

- A. Products shall be manufactured by one of the following (or equal):

- 1. **Air Entraining Agent:**

- Micro-Air by Master Builders
 - Daravair by W.R. Grace
 - Sika AEA-15 by Sika Corporation

- 2. **Set Retarding Admixture:**

- Plastocrete by Sika Corporation
 - Pozzolith 300R by Master Builders
 - Daratarad by W.R. Grace

- 3. **Set Accelerating Admixture:**

- Plastocrete 161FL by Sika Corporation
 - Pozzutec 20 by Master Builders
 - Daraset by W.R. Grace

- 4. **Normal Range Water Reducer:**

- WRDA 79 by W.R. Grace
 - Pozzolith 322-N by Master Builders
 - Plastocrete 161 by Sika Corporation

- 5. **High Range Water Reducer:**

- Daracem 100 or WRDA 19 by W.R. Grace
 - Sikament FF or Sikament 86 by Sika Corporation
 - Rheobuild 1000 or Rheobuild 716 by Master Builders

- 6. **Curing Compound:**

- Aqua Resincure by Burke
 - Aqua-cure by Euclid Chemical Company
 - Masterkure-W by Master Builders

- 7. **Evaporation Retardant:**

Confilm by Master Builders
Eucobar by Euclid Chemical Company

8. **Dampproofing Agent:**

Hydrocide 600 by Sonneform
Sealmastic by W.R. Meadows
Damp proofing Asphalt Coating by Euclid Chemical Company

9. **Agents for Bonding Freshly-Mixed Plastic Concrete to Hardened Concrete:**

Sikadur 32 Hi-Mod Epoxy Adhesive by Sika Corporation
Concresive liquid (LPL) by Master Builders
BurkEpoxy MV by Burke

10. **Agents for Bonding Hardened Concrete to Steel:**

Sikadur 31 Hi-Mod Gel by Sika Corporation
BurkEpoxy NS by Burke
Concresive Paste (LPL) by Master Builders

11. **White Portland Cement:**

Atlas White

PART 3 -- EXECUTION

3.1 PROPORTIONING AND MIXING

- A. **Proportioning:** Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.
- B. **Mixing:** Mixing of concrete shall conform to the requirements of Chapter 7 of ACI 301.
- C. **Slump:** Maximum slumps shall be as indicated.
- D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

- A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. **Joints in Concrete up to 60 Days Old:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as

determined by the CONSTRUCTION MANAGER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

- C. After the surfaces have been prepared all approximately horizontal construction joints shall be covered with a 6-inch lift of the pea gravel mix indicated above. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.
- D. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the CONSTRUCTION MANAGER.
- E. **Embedded Items:** No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the CONSTRUCTION MANAGER at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- F. All inserts or other embedded items shall conform to the requirements herein.
- G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the CONSTRUCTION MANAGER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.
- H. **Casting New Concrete Against Concrete over 60 Days Old:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the CONSTRUCTION MANAGER.
- I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the CONSTRUCTION MANAGER.
- J. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of

concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

- K. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.
- L. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.
- M. **Cleaning:** The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

- A. **General:** Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.
- B. **Non-Conforming Work or Materials:** Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.
- C. **Unauthorized Placement:** No concrete shall be placed except in the presence of duly authorized representative of the CONSTRUCTION MANAGER. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing at least 24 hours in advance of placement of any concrete.
- D. **Placement in Wall Forms:** Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- E. **Conveyor Belts and Chutes:** All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of an

acceptable type. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

- F. **Placement in Slabs:** Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.
- G. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.
- H. **Cold Weather Placement:** Remove all snow, ice and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

3.4 PUMPING OF CONCRETE

- A. **General:** If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. **Pumping Equipment:** The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.
- C. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.
- D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.
- E. Aluminum conduits for conveying the concrete shall not be permitted.
- F. **Field Control:** Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.

3.5 ORDER OF PLACING CONCRETE

- A. The order of placing concrete in all parts of the work shall be acceptable to the CONSTRUCTION MANAGER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days for hydraulic structures and 3 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for all other structures.
- B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309) high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required. Group 2 vibrators may be used only at specific locations when accepted by the CONSTRUCTION MANAGER.
- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

- A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and were indicated above. Tolerances are to be distinguished from irregularities in finish as described below. Aluminum finishing tools shall not be used.
- B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects.
 - 1. Surface holes larger than ½ inch in diameter or deeper than ¼ inch are defined as surface defects in basins and exposed walls.
- C. **Unformed Surfaces:** After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
 - 1. **Finish U1** - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
 - 2. **Finish U2** - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the CONSTRUCTION MANAGER.
 - 3. **Finish U3** - After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
 - 4. **Finish U4** - Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.
- D. **Unformed surfaces shall be finished according to the following schedule:**

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
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Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs not water bearing	U4

E. **Floor Sealer/Hardener (Surface Applied): (Not Used)**

F. **Sandblasted Concrete Finish (Not Used)**

3.8 ARCHITECTURAL FINISH (NOT USED)

3.9 CURING AND DAMPPROOFING

A. **General:** All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the work, and described in detail in the following paragraphs:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	4 or 6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs not on grade	6

B. **Method 1:** Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.

C. **Method 2:** The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. **Method 3:** The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. **Method 4:** The surface shall be sprayed with a liquid curing compound.

1. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moistureproofed, or where any coverings are to be bonded.

2. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.
3. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
4. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
5. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.
6. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the previously coated panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.
7. Prior to final acceptance of the WORK, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage surface finish.

F. Method 5:

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.
2. The curing blankets shall be left in place during the 14-day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the

curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. Method 6:

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes and to be substantially in contact with the concrete surface. All edges shall be continuously held in place.
4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4, herein.
6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the work.

H. Dampproofing (not used)

3.10 PROTECTION

- A. The CONTRACTOR shall protect all concrete against injury until final acceptance by the OWNER.
- B. Fresh concrete shall be protected from damage due to rain. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

3.11 CURING AND THERMAL PROTECTION IN COLD WEATHER (NOT USED)

3.12 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the

CONSTRUCTION MANAGER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

- B. Defective surfaces to be repaired shall be cut back from true line a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete.
- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.
- D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

3.13 PATCHING HOLES IN CONCRETE

A. Patching Small Holes:

1. Holes which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.
2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph above.
3. Small holes through all other concrete members shall be filled with non-shrink grout, with exposed faces treated as above.

B. Patching Large Holes:

1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.
2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.

3.14 CARE AND REPAIR OF CONCRETE

- A. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the OWNER. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

**** END OF SECTION ****

SECTION 03315 – GROUT

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing grout other than that required for masonry work, complete.
- B. The following types of grout are included in the WORK of this Section:
 - 1. Non-Shrink Grout: This type of grout shall be used wherever grout is required, unless another type is specifically indicated.
 - 2. Cement Grout
 - 3. Epoxy Grout
 - 4. Topping Grout and Concrete Fill

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 03300 Cast-in-Place Structural Concrete

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current versions of the following apply to the WORK of this Section:

CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing
ASTM C 827	Test Method for Early Volume Change of Cementitious Mixtures
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grouts proposed for use in the WORK.
 - 2. Certified test results verifying the compressive strength, shrinkage, and expansion properties for proposed non-shrink and epoxy grouts.

1.5 TESTING DURING CONSTRUCTION

A. **Field Tests:**

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the CONSTRUCTION MANAGER to insure continued compliance with these specifications. The specimens will be made by the CONSTRUCTION MANAGER or its representative.
2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the CONSTRUCTION MANAGER. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the CONSTRUCTION MANAGER. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.
4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.
5. The cost of all laboratory tests on grout will be borne by the OWNER, but the CONTRACTOR shall assist the CONSTRUCTION MANAGER in obtaining specimens for testing. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

PART 2 -- PRODUCTS

2.1 CEMENT GROUT

- A. **Cement Grout:** Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.
- B. Cement grout materials shall be as indicated in Section 03300.

2.2 PREPACKAGED GROUTS

A. **Non-Shrink Grout:**

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the manufacturer for the particular application.
2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.
4. **Application:**
 - a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout indicated herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.
 - b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 F.
4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 14,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.
6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.
7. **Application:** Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 TOPPING GROUT AND CONCRETE FILL

- A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as indicated herein. All materials and procedures specified for concrete in Section 03300 shall apply except as indicated otherwise herein.
- B. Topping grout and concrete fill shall contain a minimum of 611 pound of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, structural concrete as indicated in Section 03300 may be used when accepted by the CONSTRUCTION MANAGER.
- C. Coarse aggregate shall be graded as follows:

<u>U.S. STANDARD SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING</u>
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. **Strength:** Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 3000 psi.

2.4 CURING MATERIALS

- A. Curing materials shall be as indicated in Section 03300 for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as required for the particular application.
- B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.6 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

2.7 MANUFACTURERS

- A. Products shall be of the following manufacture (or equal):
 - 1. **Epoxy Grout:** Epoxy Grout J55 by Dayton Superior
Sika Grout 328
Sikadur 42 Grout-Pak by Sika Corporation

PART 3 -- EXECUTION

3.1 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300. The finish of the grout surface shall match that of the adjacent concrete.
- B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the CONSTRUCTION MANAGER.

3.2 GROUTING PROCEDURES

- A. **Prepackage Grouts:** All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. **Base Plate Grouting:**
 - 1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for an one-inch thickness of grout or a thickness as indicated.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the CONSTRUCTION MANAGER, alternate grouting methods shall be submitted for acceptance.
- C. **Topping Grout:**
 - 1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
 - 2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.

3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.3 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

** END OF SECTION **

SECTION 05500 - MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing miscellaneous metalwork and appurtenances including the following:
1. Anchor Bolts
 2. Power Driven Pins (Not Used)
 3. Bolts
 4. Seat Angles, Supports and Brackets (Not Used)
 5. Iron Castings (Not Used)
 6. Gratings (Not Used)
 7. Pipe Columns (Not Used)
 8. Floor and Cover Plates (Not Used)
 9. Steel Stairs (Not Used)
 10. Safety Stair Treads (Not Used)
 11. Floor Hatches (Not Used)
 12. Fall Prevention System (Not Used)
 13. Manhole Frames and Covers (Not Used)

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
1. Section 03300 Cast-in-Place Structural Concrete
 2. Section 03315 Grout

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
1. California Building Code

1.4 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.5 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
1. **Federal Specifications:**

QQ-F-461 C (1)	Floor Plate, Steel, Rolled
MIL-6-18015	(Ships) Aluminum Planks, (6063-T6)

2. Commercial Standards:

AISC MO11	Manual of Steel Constructions
AASHTO HS-20	Truck Loading
ASTM A36 / A992	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 53	Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 125	Specification for Steel Springs, Helical, Heat Treated
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 240	Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 276	Specification for Stainless Steel Bars and Shapes
ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A 320	Specification for Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM A 489	Carbon Steel Eyebolts
ASTM A 569	Specification for Steel, Carbon, (0.15 Maximum Percent) Hot Rolled, Sheet and Strip, Commercial Quality
ASTM A 575	Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 666	Specification for Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar
ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
ASTM B 438	Specification for Sintered Bronze Bearings (Oil-Impregnated)
ASTM B 439	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ASTM B 695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
ASTM F436	Standard Specification for Hardened Steel Washers.

ASTM F594	Standard Specification for Stainless Steel Nuts.
ASTM F1267	Metal, Expanded, Steel
ANSI/AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code - Aluminum.
AWS D1.3	Structural Welding Code – Sheet Steel
AWS D1.6	Structural Welding Code – Stainless Steel
AWS D10.18	Pipe Welding Code – Stainless Steel
AWS A2.4	Standard Welding Symbols
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.6 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in addition to General Requirements:
1. Shop drawings showing proposed use of adhesive anchors.
 2. Welding procedures and welder qualifications.
 3. Submit samples of material or fabricated items if requested by the Engineer.

1.7 OWNER'S MANUAL

- A. The following shall be included in the OWNER'S MANUAL:
1. Manufacturer's installation instructions.

PART 2 -- PRODUCTS

2.1 MISCELLANEOUS METALWORK

- A. **Materials:** Except as otherwise indicated, products fabricated of structural steel shapes, plates and bars shall comply with the requirements of ASTM A 36 Grade 36 & A992 Grade 50.
- B. **Corrosion Protection:** Miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment or will be submerged shall be stainless steel. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication and coated with Two component aliphatic acrylic polyurethane coating. Surface preparation and primer shall be as recommended by manufacturer. Minimum DFT for prime coat and finish coat shall be 4 mils and 3 mils respectively. Total system DFT shall be 7 mils minimum. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.
- C. **Stainless Steel:** Stainless steel metalwork shall be of Type 316 L stainless steel. Stainless steel shall not be torch heated for welding. The CONTRACTOR shall submit welding methods and procedures. All welded stainless steel shall be passivated after welding by immersing in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric acid. Temperature and detention time for passivation shall be sufficient for removal of oxidation and ferrous contamination without etching of surface. The passivated steel shall undergo a complete neutralization by immersion in a detergent rinse followed by clean water wash, or

shall be buffed with Scotch Brite EXL (or equal) for removal of weld discoloration and heat tint.

- D. **Welding:** Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" and supplemented by other standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
- E. **Galvanizing:** Where galvanizing is indicated, structural steel plates shapes, bars and fabricated assemblies shall be thoroughly cleaned of rust and scale and shall be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts (except ASTM A325), anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

2.2 ANCHOR BOLTS

A **General:** Anchor bolts shall comply with the following:

1. Anchor bolts shall be fabricated of materials complying with SSPWC Subsections 206-1.4.1 and 209-2.2 and as follows:

Steel bolts	ASTM A325
Fabricated steel bolts	ASTM A36
Stainless steel bolts, nuts, washers	ASTM A320, Type 316

2. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a maximum oversizing of 1/4 inch. Unless otherwise indicated, minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment shall be 316 stainless steel and shall be provided with leveling nuts which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.
3. Tapered washers shall be provided where mating surface is not square with the nut.
4. Expansion, wedge, or adhesive anchors set in holes drilled in the concrete after the concrete is placed is not permitted as substitution for anchor bolts except where otherwise indicated. Upset threads shall not be acceptable.
5. ASTM A307 anchor bolts are prohibited.

B. **Adhesive Anchors:** Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. Substitutions will not be considered unless accompanied with ICC report

verifying strength and material equivalency and approved by the Engineer. Except as otherwise indicated, adhesive anchors shall comply with the following:

1. Epoxy adhesive anchors may be provided for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Threaded rod shall be stainless steel Type 316.
2. Glass capsule, polyester resin adhesive anchors may be permitted in other locations.

- C. **Expanding-Type Anchors:** Expanding-type anchors, where indicated, shall be Type 316 stainless steel. Size shall be as shown. Expanding-type anchors are prohibited from use in corrosive areas and in deteriorating concrete.

2.3 POWER DRIVEN PINS (NOT USED)

2.4 BOLTS

- A. **Bolt Requirements:** Bolts shall comply with the following:

1. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
2. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

- B. **Standard Service Bolts (Not Buried or Inside Tanks or Channels):** Except where otherwise indicated, bolts and nuts shall be steel and shall be galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 325, or threaded parts of ASTM A 36. ASTM A 325 bolts and nuts shall not be galvanized.

- C. **Bolts Buried or Inside Tanks or Channels:** Unless otherwise indicated, bolts, anchor bolts, nuts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.

- D. Unless otherwise indicated, eyebolts shall conform to ASTM A 489.

2.5 SEAT ANGLES, SUPPORTS AND BRACKETS (NOT USED)

2.6 IRON CASTINGS (NOT USED)

2.7 GRATINGS (NOT USED)

2.8 FLOOR AND COVER PLATES (NOT USED)

2.9 STAIRS (Not Used)

- 2.10 SAFETY STAIR TREAD (Not Used)
- 2.11 FLOOR AND ROOF HATCHES (Not Used)
- 2.12 PIPE COLUMNS (Not Used)
- 2.13 FALL PREVENTION SYSTEM (Not Used)
- 2.14 MANHOLE FRAMES AND COVERS (Not Used)
- 2.15 MANUFACTURERS
 - A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):
 - 1. **Epoxy Adhesive Anchors:**
 - Hilti RE-500 or Hilti HY 200 Epoxy Anchor System
 - Red Head Epcon G5 Epoxy Adhesive
 - 2. **Glass Capsule Polyester Resin Adhesive Anchors:**
 - Hilti HY-150 Or Hilti HFX Injection Adhesive
 - Red Head Epcon A7 Acrylic Adhesive
 - 3. **Expanding-Type Anchors:**
 - Red Head Trubolt
 - Hilti Kwik-Bolt 3
 - 4. **Steel Gratings: (Not Used)**
 - Grating Pacific Type 19-4
 - McNichols Type GW
 - 5. **Floor and Cover Plates: (Not Used)**
 - Alcoa C-102 Aluminum Tread Plate
 - Reynolds Diamond Tread Plate
 - 6. **Field Repairs to Galvanizing:**
 - "Galvinox"
 - "Galva-Guard"
 - 7. **Aluminum Grating: (Not Used)**
 - Grating Pacific
 - Seidelhuber

PART 3 -- EXECUTION

3.1 GENERAL

- A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
- B. **General:** Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Grouting of anchor bolts with nonshrink or epoxy grouts, where indicated, shall be in accordance with Section 03315.
 - 1. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
 - 2. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if indicated, recesses or blockouts shall be formed in the concrete. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned. Recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place. Embedments shall comply with Section 03300.
 - 3. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.
 - 4. Fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work shall be performed prior to hot-dip galvanizing.

3.2 INSTALLATION OF ANCHOR BOLTS

- A. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.
- B. Installation of adhesive, capsule and expansion anchors shall comply with the following:
 - 1. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.
 - 2. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above 120 degrees F is not indicated. Overhead applications (such as pipe supports) shall not be allowed.
 - 3. Use shall be limited to locations where exposure to acid concentrations higher than 10 percent, to chlorine gas, or to machine or diesel oils, is not indicated.
 - 4. Concrete temperature (not air temperature) shall be compatible with curing requirements recommended by adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.
 - 5. Anchor diameter and grade of steel shall comply with equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.

6. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.
 7. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
 8. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.
 9. Anchor shall be left undisturbed and unloaded for full adhesive curing period.
- 3.3 INSTALLATION OF SEAT ANGLES, SUPPORTS AND GUIDES (Not Used)
- 3.4 INSTALLATION OF GRATING, FLOOR AND COVER PLATES (Not Used)
- 3.5 INSTALLATION OF DRILLED ANCHORS
- A. Drilled anchors shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the indicated 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

** END OF SECTION **

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing general requirements for the WORK of applicable Sections of these Specifications. Unless there are more restrictive requirements in the individual Sections, the provisions of this Section shall apply.
- B. The WORK of this Section applies to the WORK of the following Sections:
 - 1. Equipment in Divisions 11, 13, 15 and 16.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 05500 Miscellaneous Metalwork
 - 2. Section 11002 Equipment Supports, Grouting and Installation
 - 3. Section 11005 Machine Alignment
 - 4. Section 13300 Instrumentation and Control
 - 6. Section 15000 Piping Components
 - 7. Section 15020 Pipe Supports
 - 8. Section 16030 Electrical Tests
 - 9. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. California Mechanical Code (CMC)
 - 2. California Plumbing Code (CPC)
 - 3. California Fire Code (CFC)
 - 4. National Electrical Code (NEC)
 - 5. California Building Code (CBC)

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the applicable standards of the following organizations apply to the WORK of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Public Health Association (APHA)
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Mechanical Engineers (ASME)
 - 5. American Water Works Association (AWWA)

6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. National Electrical Manufacturers Association (NEMA)
10. Antifriction Bearing Manufacturers Association (ABMA)
11. American Gear Manufacturers Association (AGMA)

B. The current editions of the following apply to the WORK of this Section:

ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys
ANSI B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
ANSI/ASME B31.1	Power Piping
ANSI/AWWA D100	Welded Steel Tanks for Water Storage
AWWA C206	Field Welding of Steel Water Pipe
ASTM A 48	Specification for Gray Iron Castings
ANSI A 58.1	Minimum Design Loads for Buildings and Other Structures
ASTM A 108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
ANSI/NFPA 70	National Electrical Code
MIL STD 167-2	Mechanical Vibrations of Shipboard Equipment (Reciprocating Machinery and Propulsion System and Shafting)

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product data including catalogue cuts.
2. Equipment name, identification number and specification numbers.
3. Shop drawings showing details, dimensions, anchorage details, and installation of equipment with all special fittings, appurtenances and required clearances.
4. Shipping weights.
5. Calculations of equipment anchorage forces and anchorage details.
6. Certification that the single manufacturer accepts the indicated unit responsibilities.
7. Parts list with materials of construction by ASTM reference and grade.

8. List of at least 5 installations and telephone numbers, where identical equipment has been used.
9. Documentation of experience of specialist who will perform torsional and vibration analysis.
10. Torsional and lateral vibration analysis reports.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's catalog including installation instructions.
2. Manufacturer's operating and maintenance procedures including lubricating instructions.
3. Manufacturer's certification that products comply with the indicated requirements.
4. Bearing L-10 life calculations.
5. Certification that products have been factory-tested and found to conform with the contract requirements.
6. Certification that the WORK has been field-tested and the WORK complies with the indicated requirements.
7. Equipment tolerances
8. Electrical data including control and wiring diagrams.
9. Address and telephone number of local service representative.

1.7 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment:** An authorized service representative of the manufacturer shall visit the site and witness the following:

1. Installation of the equipment.
2. Inspection, checking, and adjusting the equipment.
3. Startup and field-testing for proper operation.
4. Performing field adjustments to ensure that the equipment installation and operation comply with the Specifications.

B. **Instruction of OWNER'S Personnel:**

1. An authorized service representative of the manufacturer shall instruct the OWNER'S personnel in the operation and maintenance of the equipment, including step-by-step

troubleshooting with necessary test equipment. Training shall be specific to the models of equipment provided.

2. The representative shall have at least one year of qualified experience in training covering the relevant subjects described in paragraph 11000-1.7B.1. A resume for the representative shall be submitted to the CONSTRUCTION MANAGER.
 3. Training shall be scheduled a minimum of 3 weeks in advance of the first session.
 4. Proposed training material and a detailed outline of each lesson shall be developed in accordance with the requirements, and submitted to the CONSTRUCTION MANAGER for review. Comments from the CONSTRUCTION MANAGER shall be incorporated into the material.
 5. Training materials shall remain with the trainees.
 6. The OWNER may videotape the training sessions for later use with the OWNER'S personnel.
- C. **Local Service:** The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

1.8 FACTORY INSPECTION AND TESTING

- A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for the number of days indicated to complete such inspections or observations, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.
- B. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements. The CONTRACTOR shall provide the CONSTRUCTION MANAGER a written notification of testing dates at least 2 weeks in advance of testing, unless more advance notice is specified elsewhere.
- C. **Balancing:** Rotating elements of equipment, except small, commercially packaged equipment, shall be statically and dynamically balanced at the factory prior to final assembly. The CONTRACTOR shall furnish certified copies of all test results.

1.9 FIELD TESTING

- A. **Testing:** Products shall be field-tested for compliance with the indicated requirements.
- B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness field tests.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.
- B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.
- C. **Protection of Equipment:** Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings. Gears and bearings to be stored for extended periods shall be containerized suitable for export shipment.
- D. **Investigation of Failed Products:** Prior to disposal of failed products, the CONTRACTOR shall investigate the causes of failure and submit a report to the CONSTRUCTION MANAGER, who will subsequently direct the CONTRACTOR for disposal.

1.11 UNIT RESPONSIBILITY

- A. Equipment systems made up of two or more components shall be provided as a unit by the manufacturer of the driven equipment. The manufacturer of the driven equipment shall assume the unit responsibility. Unless otherwise indicated, the CONTRACTOR shall cause each system component to be furnished by the manufacturer with unit responsibility. The extent of the manufacturer's responsibilities shall include engineering the specified equipment, preparation of all submittal materials, coordinating manufacture and procurement, compatibility and shipment of all specified components, design of all equipment supports, providing installation and testing specialists to assist the CONTRACTOR in completing the installation and commissioning the equipment, furnishing factory certified specialists to train the OWNER's staff, and the production and submission of specified operation and maintenance manuals. The CONTRACTOR is responsible to the OWNER for performance of all systems as indicated. The CONTRACTOR shall ensure the submittal of a Certificate of Unit Responsibility signed by the manufacturer with unit responsibility.

1.12 TORSIONAL AND VIBRATION ANALYSIS

- A. **Torsional Analysis:** The drive train shall be free from torsional criticals which produce combined (steady plus transient torque induced) stresses exceeding 30 percent of the material's elastic limit (but no more than 18 percent of the material's ultimate tensile strength) at any speed from 20 percent below to 30 percent above the operating speeds required by the specified operating conditions, or during startup, shutdown or drive control transients. In accordance with MIL STD 167-2, under no circumstances shall combined torsional steady state and transient vibratory stresses exceed 4 percent of the material's ultimate tensile strength, nor more than 50 percent of the material's fatigue limit, whichever is less. Stress concentration factors to be used in the equation:

$$S = Scf \times \frac{(G \times D \times \Delta \theta)}{2L}$$

where:

- S = stress, psi
- Scf = stress concentration factor, dimensionless
- D = minimum shaft diameter, inches, at point of concentration
- "~ = twist in shaft between adjacent masses, radians
- L = effective length between masses, inches
- G = shear modulus of material, lb/in²

The Scf, to be applied at all the roots of all keyways and changes in shaft diameter shall be as follows:

Scf	Ratio of fillet radius to shaft diameter
4.3	0.0025
3.7	0.01
3.05	0.02
2.75	0.03
2.6	0.04
2.55	0.05 and greater

Values of Scf between data points in the table above shall be based upon a straight line interpolation.

One analysis is required for each piece of unique equipment and for each set of identical equipment assigned to the same application. This general requirement is applicable under the individual equipment specifications or the equipment type general specifications where more detailed torsional, vibration, critical speed, and/or shaft deflection analyses may be required.

The CONTRACTOR shall submit to the CONSTRUCTION MANAGER a torsional and lateral vibration analysis of the following equipment. The analysis shall be performed by a specialist who has performed, in the recent past, a torsional and lateral vibration analysis on at least one project of comparable size and complexity. The specialist shall be approved by the CONSTRUCTION MANAGER.

1. All engine drives.
2. All blowers and compressors with drives of 100 horsepower and over.
3. All vertical pumps with universal joints and extended shafts.
4. All equipment with variable speed drives, 25 horsepower and over.
5. All other equipment where indicated.

During construction and testing of all engine driven equipment and all gear driven equipment, the torsional analysis specialist shall visit the site and conduct a field torsionograph test on one randomly selected unit in each set of these equipment to verify the desktop torsional analysis. The test shall be conducted on selected accessible portions of the rotating equipment when operating throughout the full range of specified operating conditions.

- B. **Field Vibration Analysis:** During construction and testing of all engine driven equipment and all 100 horsepower and larger motor driven equipment operating at less than 1,200 rpm, the above mentioned torsional analysis specialist shall make at least two site visits to analyze and measure the amount of equipment vibration and make a written recommendation for keeping the vibration at a safe limit. The vibration analysis is required for each piece of rotating equipment.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **General:** Only products meeting the indicated requirements shall be provided.
- B. **Manufacturers:** Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.
- C. **Products:** Materials shall be suitable for the intended purpose and free of defects and shall be recommended by the manufacturer for the application indicated.
- D. **No Endorsement:** The listing of a manufacturer shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the indicated requirements. No preference is implied by the order of listing of named manufacturers, and the listings are not intended to be comprehensive. The manufacturer listings are only an indication that the OWNER and DESIGN CONSULTANT believe that the named manufacturers are capable of producing equipment and products which will satisfy the indicated requirements.

2.2 GENERAL REQUIREMENTS

- A. **Noise Level:** When in operation, no piece of equipment shall exceed the OSHA noise level requirements for a one hour exposure.
- B. **Personal Hearing Protection:** The WORK includes multiple sets of three pairs of high attenuation hearing protectors complying with the requirements of ANSI S12.6 and producing a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. One set of hearing protectors shall be stored in a weatherproof, labeled, steel cabinet which shall be mounted in a location near each noise producing equipment installation.
- C. **Service Factors:** Service factors shall be applied in the selection and design of mechanical power transmission components where so indicated in individual Sections. When not indicated there, minimum service factors shall be 1.25.
- D. **Welding:** Except as otherwise indicated, welding shall comply with ANSI/AWWA D100 and AWWA C206 and the following:
 - 1. Composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds and shall prevent entrance of air or moisture.

2. Welding shall be by the metal-arc method or gas-shielded arc method described in the American Welding Society's "Welding Handbook" as supplemented by other AWS standards. Qualification of welders shall comply with AWS Standards.
 3. In assembly and during welding, the component parts shall be clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
- E. **Identification of Equipment Items:** Each item of equipment shall have an indelible, legible identifying mark corresponding to the equipment number indicated.
- F. **Vibration Level:** Except as otherwise indicated, equipment subject to vibration shall be provided with restrained spring-type vibration isolators or pads complying with the manufacturer's written recommendations.
- G. **Shop Fabrication:** Shop fabrication shall be performed in accordance with the shop drawings.
- H. **Tolerances:** The variation in length of members without machine finished ends and which are to be framed shall not exceed 1/16-inch for members 30 feet or less and shall not exceed 1/8-inch for members over 30 feet.
- I. **Machine Finish:** The type of finish shall be the most suitable for the application in micro-inches complying with ANSI B46.1. The following finishes shall be used:
1. Surface roughness of surfaces in sliding contact shall not exceed 63 micro-inches.
 2. Surface roughness shall not exceed 250 micro-inches except where a tight joint is indicated.
 3. Surface roughness for other mechanical parts shall not exceed 500 micro-inches.
 4. Surface roughness of contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall not exceed 32 micro-inches.
- J. **Seismic Design:** The seismic design of equipment shall be based on the horizontal peak ground acceleration indicated in the Geotechnical Report or in accordance with California Building Code 2010 (CBC), whichever is greater. Unless otherwise indicated, Occupancy Category shall be III, and seismic design importance factors shall be $I = 1.25$, $I_p = 1.5$ in accordance with Table 11.5-1 per ASCE7-10. Determination of seismic forces and load combinations shall follow procedures in the ASCE7-10, Chapter 13.

2.3 EQUIPMENT SUPPORTS AND FOUNDATIONS

- A. **Equipment Supports:** Equipment supports, anchors, and restrainers shall be designed for static, dynamic, wind, and seismic loads. The design horizontal peak ground acceleration

shall be the greater of that indicated in the Geotechnical Report or as required by the California Building Code 2010. Unless otherwise indicated, Occupancy Category shall be III, and seismic design importance factors shall be $I = 1.25$, $I_p = 1.5$ in accordance with Table 11.5-1 per ASCE7-05. Determination of seismic forces and load combinations shall follow procedures in the ASCE7-05, Chapter 13.

- B. **Equipment Foundations:** Unless otherwise indicated, equipment foundations shall conform to the requirements of Section 11002.

2.4 PIPE HANGERS, SUPPORTS, AND GUIDES

- A. Pipe connections to equipment shall be supported, anchored, and guided to minimize stresses and loads on equipment flanges and equipment. Supports and hangers shall comply with the requirements of Section 15020.

2.5 FLANGES AND PIPE THREADS

- A. Flanges on equipment shall comply with ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise indicated. Threaded flanges and fittings shall have standard taper pipe threads complying with ANSI/ASME B1.20.1.

2.6 COUPLINGS

- A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to minimize shock loads. Where required for vertical shafts, 3-piece spacer couplings or universal type couplings for extended shafts shall be installed.
- B. The equipment manufacturer shall recommend the size and type of coupling required for each specific application.
- C. Taper-lock bushings may be used where indicated.
- D. Where universal type couplings are indicated, they shall be of the needle bearing type construction, equipped with commercial type grease fittings. Bearings shall be sized in accordance with ABMA 11, using a 1.25 service factor, for the same L-10 life expectancy as the driven equipment, but not less than 50,000 hours.

2.7 SHAFTING

- A. **General:** All shafting shall be continuous between bearings and shall be sized properly to transmit the power required. Keyways shall be provided in accordance with standard practice.
- B. **Materials:** Shafting materials shall be selected for the type of service and torque transmitted and the effect of corrosive gases, moisture, and fluids shall be considered. Unless otherwise specified, materials shall conform to the following:
 1. Low carbon cold-rolled steel shafting: ASTM A 108, Grade 1018.
 2. Medium carbon cold-rolled shafting: ASTM A 108, Grade 1045.

3. Corrosion-resistant shafting: stainless steel or Monel, whichever is most suitable for the intended service.
 4. **Extended shafting:** carbon fiber/resin composite.
- C. **Differential Settlement:** Where differential settlement between the driver and the driven equipment is indicated, an extension shaft with 2 sets of universal type couplings shall be provided.

2.8 BEARINGS

- A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (ABMA).
- B. Bearing selection shall include the following criteria: fitting practice, mounting, lubrication, sealing, static rating, and housing strength.
- C. Re-lubricatable type bearings shall be equipped with an Alemite type hydraulic grease fitting in an accessible location.
- D. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's best recommended grease to insure maximum bearing life and best performance.
- E. Except where otherwise indicated, bearings for process equipment shall be selected for a minimum L-10 life expectancy of 50,000 hours for intermittent service and 100,000 hours for continuous service, in accordance with ABMA 9 or 11. Anti-friction bearings for pumps with discharge nozzle sizes 14 inches in diameter or greater, or pumps with a shaft diameter greater than 4 inches, shall be selected for an L-10 life expectancy of 100,000 hours in accordance with ABMA 9 or 11. Bearings for other elements in the rotating system such as motors, intermediate shaft bearings, right-angle gears, and flywheel bearings shall be selected using the same criteria as specified for the driven equipment, but not less than 50,000 hours. This requirement supersedes any specified bearing life in the detailed specification sections. Bearing selection shall be based upon the worst combination of continuous duty operating conditions specified and shall include both steady state and transient loads. Calculations supporting the selection of bearing sizes shall be included in the Owner's Manual.
- F. Bearing housings shall be of cast iron or steel and the bearing mounting arrangement shall be in accordance with the published standards of the manufacturer. Split-type housings may be used.
- G. Unless otherwise indicated, sleeve-type bearings shall have a Babbitt or bronze liner.

2.9 GEARS AND GEAR DRIVES

- A. Except as otherwise indicated, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum L-10 bearing life of 60,000 hours at the worst combination of specified operating conditions, in accordance with ABMA 9 or 11, and a minimum efficiency of 94 percent. Worm gears shall not be used.

- B. Gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided and installed for easy reading.
 - C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.
 - D. Material selections shall comply with AGMA values and the manufacturer's recommendations. Input and output shafts shall be properly designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have 2 positive seals to prevent oil leakage.
 - E. Oil level and drain location shall be readily accessible. Oil coolers or heat exchangers with all required appurtenances shall be included where indicated.
 - F. Where gear drive input or output shafts connect to couplings or sprockets, the gear drive manufacturer shall supply matching key.
- 2.10 DRIVE CHAINS (NOT USED)
- 2.11 SPROCKETS (NOT USED)
- 2.12 V-BELT DRIVES (NOT USED)
- 2.13 DRIVE GUARDS
- A. Power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded. Unless otherwise indicated for corrosive environment, the guards shall be constructed of minimum 10 gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.
- 2.14 FLEXIBLE CONNECTORS AND DUAL PIPE COUPLINGS
- A. Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment in accordance with the requirements of the ANSI B31.1.
 - B. Dual pipe couplings, separated by an 18-inch pipe spool unless otherwise indicated, shall be installed on the suction and discharge of all pumps - inboard of the isolation valves. Dual pipe couplings, separated by not less than two pipe diameters nor more than 5 feet, shall be installed on all piping where it exits a structure. Couplings shall be restrained where required. Dual flexible pipe joints may be used where indicated in buried pipe applications in lieu of dual pipe couplings. Flexible connectors are not permitted where dual pipe couplings are specified.
- 2.15 INSULATING CONNECTIONS
- A. Insulating bushings, unions, couplings, and flanges, shall comply with the requirements of Section 15000.

2.16 GASKETS AND PACKINGS

- A. Gaskets shall comply with the requirements of Section 15000.
- B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal," or equal.
- C. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer.

2.17 TOOLS AND SPARE PARTS

- A. **Tools:** The WORK includes one complete set of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.
- B. **Spare Parts:** All equipment shall be furnished with the manufacturers' recommended spare parts, as indicated in the individual equipment Sections.

Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.

2.18 NAMEPLATES

- A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in accessible locations with stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.19 OVERLOAD PROTECTION

- A. **General:** Where indicated, mechanical or electronic overload protection devices shall be installed on equipment.
- B. **Mechanical System:** The overload protection shall be a mechanical device designed to provide reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut which shall be tamper proof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cutout switch set for 100 percent of maximum continuous running torque. A visual torque indicator shall be provided

and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque. The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor and corrosive environments with a protective finish, corrosion inhibiting lubricants and a stainless steel cover.

- C. **Electronic System:** Overload protection may be an Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for startup and a voltage monitoring and compensation circuit for up to ± 15 percent variation.

The overload device shall have an enclosure suitable for outdoor installation at temperatures of 0-70 degrees C, and relative humidity up to 95 percent. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.

The torque monitoring system shall be calibrated to include: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.

- D. **Definition:** For the purpose of these Specifications, "maximum continuous running torque" shall be defined as the lesser of: the motor continuous running torque rating, the gear drive continuous running torque rating, or the driven mechanism continuous running torque rating, not exceeding a service factor of 1.0.

- E. **Manufacturers:** Overload protection devices shall be manufactured by the following (or equal):

1. American Autogard Corporation
2. Ferguson Machine Company

2.20 ANCHOR BOLTS, NUTS AND WASHERS

- A. Unless otherwise indicated, anchor bolts, nuts and washers for anchoring equipment to foundations and connecting bolts for equipment assemblies supported by other assemblies shall conform to the requirements of Section 05500. Unless otherwise specified, the CONTRACTOR shall provide Type 316 stainless steel anchor bolts and washers, and Type 416 stainless steel or other corrosion resistant, non-galling alloy nuts. In ferrous chloride and ferric chloride containment areas, unless otherwise specified, provide Hastelloy C or Alloy 276 anchor bolts, nuts, washers and connecting bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. **General:** Products and equipment shall be installed in accordance with the manufacturer's written installation instructions, the requirements of this Section, the requirements of the individual equipment specifications, and as indicated.

- B. **Alignment:** Journeymen millwrights shall perform alignment of equipment furnished under this Section and any referencing section. Carpenters, laborers or any other trades are specifically excluded from performing this work. In locations where such trades are not available, the CONTRACTOR shall retain the services of a firm specializing in this type of work to perform the setting and alignment work. The CONTRACTOR shall submit the qualifications of the proposed firm to the CONSTRUCTION MANAGER for acceptance prior to performing the work. The CONSTRUCTION MANAGER shall personally witness final alignment procedures for each item of equipment as a condition precedent to beginning any work required. Alignment techniques shall conform to the requirements of Section 11005.

- C. **Lubricants:** The CONTRACTOR shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the OWNER's current lubricant supplier. The CONTRACTOR shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the CONTRACTOR shall provide the OWNER with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

3.2 COUPLINGS

- A. Couplings shall be installed in accordance with the manufacturer's installation instructions.

3.3 INSULATING CONNECTIONS

- A. Insulating connections shall be installed in accordance with the manufacturer's instructions.

3.4 PIPE HANGERS, SUPPORTS, AND GUIDES

- A. Hangers, supports, and guides shall be installed in compliance with ANSI/ASME B31.1 and with Section 15020.

3.5 BOLTS AND MISCELLANEOUS METALS

- A. Bolts, including anchor bolts, and miscellaneous metals shall comply with paragraph 11000-2.20 and Section 05500. Installation of equipment anchor bolts shall comply with Section 11002.

3.6 PACKAGED EQUIPMENT

- A. When any system is provided as pre-packaged equipment, coordination shall include space and structural requirements, clearances, utility connections, signals, outputs and features required by the manufacturer including safety interlocks.

3.7 PROTECTIVE COATING

- A. Equipment shall be painted and coated with two component, rust inhibitive polyamide cured epoxy coating material and shall provide a recoatable finish that is available in a wide selection of colors. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

**** END OF SECTION ****

SECTION 11002 - EQUIPMENT SUPPORTS, GROUTING AND INSTALLATION

PART 1--GENERAL

1.1 WORK OF THIS SECTION

- A. This Section specifies minimum requirements for equipment supports, including concrete housekeeping pads, equipment bases, supports, anchorage, and accessories with weights greater than 200 pounds. If conflict exists between this Section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.
- B. The CONTRACTOR shall provide all supports, anchorage, and mounting of all equipment, unless otherwise specified in accordance with the manufacturers recommendations, and requirements of industry standards. Each piece of equipment shall be anchored to resist the greater of the maximum lateral and vertical forces required by the local governing code or by the manufacturer of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the CONSTRUCTION MANAGER. The CONTRACTOR shall provide all elements required to resist the calculated forces described herein or required by the equipment manufacturer. The CONTRACTOR shall provide certification that for equipment, 20 horsepower and larger, anchor bolt calculations showing adequacy of bolt sizing and anchor embedment have been performed and signed by a registered structural or civil engineer.

1.2 SPECIFICATIONS AND STANDARDS

- A. This Section contains references to the following documents. It is a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed document, the requirements of this Section shall prevail.
- B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/HI 1.3.4	Centrifugal pumps, Horizontal Baseplate Design
ANSI/HI 1.4	Centrifugal Pumps B Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps : Installation, Operation and Maintenance

Reference	Title
API 610, 1995	Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services
API RECOMMENDED PRACTICE 686	Recommended Practices for Machinery Installation and Installation Design
ASTM C531	Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing.
ASTM C579	Compressive Strength of (Method/B) Chemical Resistant Mortars and Monolithic Surfacing.
ASTM C638	Tensile Properties of Plastics.
ASTM C882	Bond Strength of Epoxy-Resin Systems Used with Concrete
ASTM C884	Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C1181	Creep of Concrete in Compression
ASTM D2471	Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
SSPC	Society for Protective Coatings Specifications, Vol. 2

1.3 SHOP DRAWINGS AND SAMPLES

A. The following information shall be submitted:

1. Shop drawings for all equipment bases and anchorage details.
2. Certification of anchor bolt calculations specified in paragraph 11002-1.1 B.
3. Machine and equipment base installation schedule with manufacturers' anchor bolt torque requirements, as specified in paragraph 11002-2.1.
4. Results of grout strength tests, as specified in paragraph 11002-3.2 E.

PART 2--PRODUCTS

2.1 GENERAL

- A. Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate or soleplate grouted into place on concrete housekeeping pads. All equipment shall be mounted on concrete housekeeping pads. Under no circumstances shall equipment supports be grouted directly to concrete slabs or floors. Bases for equipment shall be hot-dip galvanized after fabrication unless otherwise specified.

Mounting pads for equipment shall have the zinc layer removed and shall be finished flat and parallel after galvanizing. Sole plates and leveling plates shall not be galvanized. Machined surfaces shall be protected with two layers of duct tape after machining and before shipment from the factory.

- B. Prior to initiating any installation efforts, the CONTRACTOR shall produce a machine base schedule containing the expected dates for setting anchor bolts, casting housekeeping pads, preparation of housekeeping pads for grouting, grouting, and final anchor bolt clamping for each item of equipment. The schedule shall list the equipment, by equipment number, and shall be accompanied by written verification of anchor bolt clamping torque from the equipment manufacturer.
- C. Installation practices shall follow the guidance presented in Chapters 4 and 5 of API Recommended Practice 686, unless superseded by more restrictive requirements of these specifications or manufacturer requirements.

2.2 CONCRETE HOUSEKEEPING PADS

- A. Concrete housekeeping pads for equipment and floor penetrations shall be at least 2 inches larger in plan than the steel or cast base and not less than 6 inches above the finished floor elevation, and shall be shaped to drain liquids away from the base. Housekeeping pad details shall follow the requirements set forth on MWW Standard Detail M-114A unless superseded by more restrictive requirements of these specifications or the requirements of the equipment manufacturer. All conduits, piping connections, drains, etc., serving the equipment, shall be enclosed by the concrete pad. Unless otherwise specified, no conduits, piping connections, drains, etc., will be accepted which rise directly from the floor.

2.3 EQUIPMENT BASES

A. General

1. Unless otherwise specified, mounting bases for equipment 20 horsepower and larger shall be a minimum of 1 inch thick. All bases shall have edges bearing on the grout surface rounded to a radius of not less than 2 inches to avoid producing stress risers on the grouted foundation. Grout pouring holes shall be provided in all bases and all bases shall have grout release holes. Except where vibration isolation systems are specified, all bases shall be grouted as specified in this Section. Internal stiffeners shall be provided and shall be designed to allow free flow of grout from one section of the base to another. The minimum acceptable opening in cross-bracing and stiffeners shall be 2 inches high by 6 inches in length. All welds shall be continuous and free from skips, blow holes, laps and pockets.
2. Equipment bases for horizontal pumps shall conform to the requirements of this Section, ANSI/HI 1.3.4, API 610 (paragraph 3.3), and shall provide common support for the pump and motor (and flywheel, if one is specified). In the event of conflict, the requirements of this Section shall govern. Eight positioning jackscrews shall be provided for all drivers and flywheels (if specified) for all horizontal pump baseplates. All bases for horizontal pumps shall be equipped with jackscrews for positioning and leveling the base prior to grouting.

3. Mounting holes for anchor bolts in the bases shall be drilled and not burned out and they shall not be open slots. All mounting studs shall be Type 316 stainless steel. Anchor bolts shall be as specified under paragraph 11002-2.6. A non-seize or non-galling compound shall be used on all threads.
4. Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar to 0.002 inch in all directions. Mounting pads shall extend not less than 1 inch on all sides beyond the position for the equipment.
5. Equipment bases - for vertical volute-type pumps weighing more than 2000 pounds - shall be soleplates or leveling boxes under individual feet or support brackets integral with the volute casting. Direct mounting of the volute on housekeeping pads will not be permitted.
6. Sole plates, mounting blocks and baseplates weighing more than 1000 pounds shall be leveled with jackscrews incorporated into the fabrication. Jackscrews shall be located in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.
7. The seismic design of equipment bases shall conform to the requirements of paragraph 11000-2.2J.

B. Type I Bases:

1. Type I bases shall be structural steel bases with thickened steel pads for doweling. The bases shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump bases, which may be "T" or "L" shaped to accommodate the equipment drive and accessories. Pump bases for split case pumps shall include supports for suction and discharge base ells, if required by the specified configuration. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified.

C. Type II/III Bases: (NOT USED)

D. Type IV Bases :

1. Type IV bases shall be cast iron. Cast iron bases located within buildings do not require galvanizing but shall be sealed prior to grouting. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. In no case shall the fastener terminate only into the metal base.

E. Sole Plates:

1. Where sole plates are provided, the underside shall be scribed with the words "THIS SIDE DOWN" using welding rod material prior to milling the equipment mating surface flat to a tolerance of not less than 0.002/foot in all directions. Sole plates shall be designed to be

installed in the housekeeping curbs shown.

2.4 GROUT FOR EQUIPMENT BASES

A. **Epoxy Grout:**

1. Unless otherwise specified, grout for equipment bases shall be non-shrinking epoxy grout conforming to the following requirements:

Test	Result
ASTM C531	Shrinkage shall be less than 0.080% and thermal expansion less than 17×10^{-6} in/in/°F
ASTM C579	Strength shall be a minimum of 12,000 psi in 7 days when tested by method B, modified.
ASTM C882	Bond strength to Portland concrete shall be greater than 2000 PSI
ASTM C884	Epoxy grout shall pass the thermal compatibility test when overlaid on Portland cement concrete
ASTM D638	Tensile strength shall not be less than 1700 psi. Modulus of elasticity shall not be less than 1.8×10^6 psi
ASTM C1181	Creep of the epoxy grout shall be less than 0.005 in/in with the test at 70°F and 140°F with a load of 400 psi
ASTM D2471	Peak exothermic temperature shall not exceed 110°F when a specimen 6 inch diameter x 12 inches high is used. Gel time shall be a least 150 minutes

2. The vehicle shall be a two-component (liquid and hardener) system designed to yield the above characteristics when combined with the manufacturer’s recommended aggregate system. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150 degrees F, with a load of 1200 psi. Aggregate for equipment base grout shall be as furnished by the manufacturer of the epoxy grout mix.

B. **Cementitious Grout**

1. Cementitious grout for use with equipment supports for equipment rated 5 horsepower and smaller or weighing less than 1000 pounds, whichever is less, shall be non-shrink grout as specified in Section 03315. Procedures for leveling and clamping equipment shall be as specified in this Section.

2.5 EPOXY PRIMER

- A. The epoxy primer shall be a lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.6 ANCHOR BOLTS

- A. Anchor bolts shall be as specified in paragraph 11000-2.20, set in PVC sleeves. Sleeves shall allow a free length projection of not less than fifteen bolt diameters above the concrete required to develop the strength of the bolt. Projection above the nut on the baseplate or soleplate shall be no more than 3/4 inch. Anchor bolts shall be located not less than 6 anchor bolt diameters from the foundation edge in all directions.

PART 3--EXECUTION

3.1 GENERAL

- A. Pumps shall be installed in accordance with this Section and ANSI/HI 1.4 and ANSI/HI 2.4. Grouting of equipment bases shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the CONSTRUCTION MANAGER accepts an alternate installation procedure in writing, baseplates shall be grouted with the equipment removed.
- B. Equipment that is not mounted on vibration isolators shall be anchored directly to the supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist all imposed forces. All forces shall be transmitted to the base in order to be anchored as required.
- C. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections. Where the equipment manufacturer requires a rigid connection between the machine and connecting piping systems (generally, this will be higher discharge head pumps), the flexible coupling shown may be deleted and the CONTRACTOR shall install the equipment in the following manner:
 - 1. The equipment housekeeping pad shall be prepared as specified under paragraph 11002-3.2 B.
 - 2. The baseplate, soleplate or leveling blocks supporting the equipment shall be installed, leveled, and grouted in place as specified.
 - 3. The equipment shall be installed, aligned and doweled in place as specified.
 - 4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding on the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.

5. All piping shall be fully supported by supports designed to accept their full weight.
 6. The final sections of pipe shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.
 7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the CONSTRUCTION MANAGER.
- D. Conduit and piping for future equipment shall be capped flush with the floor or concrete pad in such a manner to allow future connection.
- E. The CONTRACTOR shall coordinate location of electrical conduit and piping penetrations within the concrete pad and equipment base. All penetrations shall stub-up on the same side of the equipment as required for connection to the equipment. Equipment drains shall be located as required for drainage from equipment.
- F. Prior to commencing equipment installation work, the CONTRACTOR shall cause the manufacturer of the epoxy grout to be used for equipment installation to conduct a training school for the workmen to be using the product. The school shall be not less than 4 hours in length and shall cover all aspects of using the products from mixing to application. This requirement, however, shall not be construed as relieving the CONTRACTOR of overall responsibility for this portion of the work.

3.2 INSTALLATION

A. **Anchor Bolts:**

1. Prior to concrete placement, anchor bolts shall be accurately set according to the manufacturer's foundation drawings and firmly secured to prevent shifting during concrete placement. Drilled in anchor bolts will not be accepted. The bolts shall be embedded in the structural concrete to develop the full strength of the bolt. Concrete in housekeeping pads cannot be used for this purpose. All anchor bolts shall be dimensionally checked against the foundation drawings for proper length, diameter, thread length, thread projection, etc., by a representative of the equipment manufacturer prior to placing concrete. Prior to placing concrete for the housekeeping pad, plastic sleeves shall be placed around each bolt to provide for minor adjustment of bolt position prior to grouting. Sleeves shall be filled with a pliable, nonbonding material such as silicon rubber or wax to prevent contact between the concrete or grout and the anchor bolt. Bolt threads and projections in the sleeves (refer to paragraph 11002-2.6) above the structural slab shall be protected in the sleeve by heavily greasing or waxing the threads and shank with paste wax and wrapping with plastic sheeting. The protective wrapping shall be firmly secured with tie wires. The protective wrapping shall be removed prior to placing the grout.
2. The equipment manufacturer shall recommend the size of the anchor bolts for the equipment and shall also furnish the recommended tightening torque for the nuts; however, the minimum size bolt shall be 3/4 inch for equipment rated 20 to 100 horsepower, 1 inch for equipment rated over 100 to 300 horsepower and 1-1/4 inches for 300 to 500 horsepower. Anchor bolts for equipment rated over 500 horsepower shall be as recommended by the manufacturer of the equipment and as approved by the CONSTRUCTION MANAGER.

B. Concrete Housekeeping Pad Preparation:

1. After the concrete is fully cured (sample cylinders, as specified in Section 03300, shall be taken and tested for all housekeeping pads supporting equipment weighing more than 1000 pounds), the housekeeping pad shall be chipped approximately 3/4 inch to 1 inch to remove all laitance and defective or weak concrete. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the foundation. Abrasive blast, bush-hammer, jack hammers with sharp chisels or needle gun preparation of concrete surfaces to be grouted are not acceptable. The amount of concrete removed shall be such that the final baseplate or soleplate elevation results in not less than 3 inches of grout between the surface of the housekeeping pad and lower baseplate flange or the underside of the soleplate.
2. All edges shall be chamfered 2 to 4 inches at a 45-degree angle. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the foundation shall be covered with protective plastic sheeting. The grout contact surface on the housekeeping pad shall be coated with one coat (not more than 5 mils) of catalyzed epoxy resin.

C. Equipment Bases and Soleplates:

1. All surfaces of equipment bases and soleplates to be in contact with epoxy grout shall be cleaned to SP-6 and shall be primed with epoxy primer within 8 hours of cleaning.

D. Leveling and Shimming:

1. All machinery shall be mounted and leveled by millwrights. All equipment bases and equipment shall be leveled against steel surfaces. Use of other materials for leveling purposes is strictly and specifically prohibited. Unless otherwise specified, baseplates, mounting blocks and soleplates weighing less than 1000 pounds shall be leveled on stainless steel blocks 4 inches square and 1-1/2 inches thick with a hole drilled in the center for the anchor bolt, placed under the base at every anchor bolt. Leveling shall be by use of mounting blocks machined flat on all horizontal surfaces and measuring not less than 4 inches wide horizontally and shims that shall extend not less than three inches beyond the base of the equipment. Mounting blocks shall be coated with a light oil just prior to beginning the leveling and grouting work. Using precut stainless steel shims coated with a light oil between the base and the steel blocks at the anchor bolts, the CONTRACTOR shall level the equipment baseplates, soleplates or mounting blocks against the anchor bolt nuts (finger tight only) to a maximum tolerance of 0.0005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Mounting surfaces for equipment shall be coplanar within 0.002 inch in any direction. The shims shall be placed so the tabs on the shims are easily accessible. A minimum of four shims per anchor bolt shall be used. The total shim thickness at each anchor bolt shall be at least 0.015 inch. Leveling shall be against anchor bolts prior to final grouting.
2. The CONTRACTOR shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.002 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Leveling equipment shall be precision surveying equipment. Machinists' spirit levels will not be permitted for leveling purposes for any base plate or equipment foundation with a plan dimension greater than 4 feet.

3. Leveling nuts may be used for mounting equipment weighing less than 500 pounds. The CONTRACTOR shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.0005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Anchor bolt nuts shall be only finger tight during the leveling process. Wedges will not be allowed and under no circumstances shall shims be used as permanent support under baseplates, soleplates or leveling plates.

E. Grouting:

1. Grout forms shall be built of minimum of 3/4-inch thick waterproof plywood and shall be securely braced (minimum brace size shall be 2 inches x 4 inches). Forms shall provide a minimum of 2-inch hydrostatic head above the final elevation of the grout to assist in flow during installation.
2. Forms must be coated with three coats of paste wax on all areas that will come in contact with the grout to prevent the grout from bonding to the forms. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, grease, etc. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers. Blockouts shall be provided at all shimming and leveling nut positions to allow removal of shimming equipment after the grout has cured. Jackscrews shall be coated with a light oil or other acceptable bond-breaking compound.
3. The 45-degree chamfer strip shall be located at the final elevation of the grout. The final elevation of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange. The top of the grout, on baseplates with solid sides and soleplates, shall be 1.0 inch above the bottom of the baseplate or the underside of the soleplate. The grout's final elevation shall not be so high as to bond the anchor bolt nut and washer.
4. The epoxy resin and hardener shall be mixed in accordance with the grout manufacturer's recommendations. Aggregate shall be slowly added to the mixer one bag at a time. The grout should be mixed only long enough to wet out all the aggregate. Grout shall be placed at the center of one end of the baseplate or soleplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate or soleplate and out the vent holes, to eliminate voids. The grout shall be placed in a manner that avoids air entrapment using a head box to pour grout into the grout holes. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout. The CONTRACTOR shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate. Grout placement shall be continuous until all portions of the space beneath the baseplate or soleplate have been filled. Subsequent batches of grout shall be prepared so as to be ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air. When the grout has started to take an initial set (determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.

5. A grout sample shall be taken for each piece of equipment to be grouted. The sample shall be placed in a cylinder of sufficient size to yield three 2-inch x 2-inch x 2-inch test samples. The samples shall be tagged with the equipment number and ambient temperature at the time of placement. The samples shall be tested in accordance with the manufacturer's recommendations. Once the epoxy grout cylinder has been completely filled, it shall be placed next to the foundation of the equipment being grouted and allowed to cure for 48 hours. After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by an independent testing laboratory. The results shall be reported directly to the CONSTRUCTION MANAGER. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the CONSTRUCTION MANAGER.

F. Completion:

1. Upon acceptance by the CONSTRUCTION MANAGER and the equipment manufacturer's representative after the grout has reached sufficient strength, the shims shall be removed, and leveling nuts or jack screws backed off to allow the grout to fully support the equipment base, leveling block or soleplate. Removal of extended shimming material (direct mounted baseplates weighing 1000 pounds or less) shall be by sledge hammer, taking care not to damage the grout. Once shims have been removed, or jackscrews backed off, the anchor bolts shall be torqued, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer. Anchor bolts shall be torqued in increments of not more than 25 percent of final value in an alternating pattern to avoid stress concentration on the grout surface. Pockets for access to shims, or leveling nuts shall be filled with grout mix and pointed after the anchor bolts have been torqued to final values.

****END OF SECTION****

SECTION 11005 - MACHINE ALIGNMENT

PART 1--GENERAL

1.1 WORK OF THIS SECTION

- A. This Section specifies requirements for alignment of all new and modified mechanical equipment to be furnished or modified or installed equipment supplied by the Owner under this contract. Equipment with drivers 5 horsepower and less are specifically exempted from the requirements of this Section. This Section also includes requirements for alignment software and equipment to be furnished to the OWNER on commissioning of the project.

1.2 QUALITY ASSURANCE

- A. **General:** All equipment shall be aligned using laser alignment equipment to the tolerances specified by the subject equipment manufacturer or the criteria specified in this Section, whichever is more stringent.
- B. **Alignment Criteria:** Unless otherwise specified by more stringent manufacturer's requirements, all mechanical equipment affected by this specification shall be aligned to the following criteria:

Speed, rpm, maximum	Couplings		Spacer Shafts offset, mils/ inch of shaft length
	Offset (mils)	Angularity (mils/inch)	
600 and less	5.0	1.0	1.8
900	6.0	0.7	1.2
1200	2.5	0.5	0.9
1800	2.0	0.3	0.6
3600	1.0	0.2	0.3
7200	0.5	0.1	0.15

- Notes:** (1) Soft foot shall be not more than 2.0 mils for any speed. (2) Separately mounted equipment connected by offset universal joints are exempted from the offset and angularity requirements, but all units must be installed and leveled as specified in this Section.

C. Alignment Equipment

- Alignment equipment used to perform the work required under this Section shall employ laser alignment techniques to achieve the required tolerances. The equipment shall be

computer based and shall be compatible with Windows® based spreadsheets and databases. The equipment shall employ a hand-held field computer using a graphic interface to determine actual alignment and necessary corrective action to bring equipment into required tolerance. The computer shall be powered by rechargeable NiCad batteries and shall be capable of storing up to 1000 machine measurement sets, complete with labels, graphics and comments. The link between field measurement instruments and the computer shall be through infrared transmission. Cable link-dependent equipment will not be acceptable. External interface between the field computer and other processors shall be by RS-232C serial cable ports.

2. The laser emitter shall be Class 2 type, FDA 21 CFR 1000 and 1040 compliant, powered by lithium ion batteries. The laser shall operate on a 670 nm wavelength and shall have a beam, divergence of less than 0.3 microradians at a power of not more than 1 microwatt. The laser receiver shall have 5 axis capability with a resolution of 0.04 mil offset and 10 micro radians angularity.

1.3 SPECIFICATIONS AND STANDARDS

- A. This Section contains references to the following documents. They are a part of this Section and any referencing section as specified and modified. In the event of conflict between the requirements of this Section or any referencing section and those of the listed documents, the requirements of this Section or the referencing section shall prevail.
- B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
Shaft Alignment Handbook	Shaft Alignment Handbook, second edition, John Piotrowski, Marcel Decker Inc.

PART 2--PRODUCTS

2.1 EQUIPMENT

- A. Laser alignment equipment shall be Rotalign® Pro as manufactured by Ludeca, Inc., of Miami, Florida, or equal.

2.2 PRODUCTS TO BE FURNISHED TO OWNER:

- A. The following shall be furnished to the OWNER upon completion of all alignment work for the project or appropriate portion thereof and prior to substantial completion of the project or portion thereof:
 - 1. (NOT USED).
 - 2. All alignment records, in both hard copy and electronic format. The hard copy shall be signed and dated by the technician performing the alignment work and shall be witnessed by the CONSTRUCTION MANAGER.

PART 3--EXECUTION

3.1 CONSTRUCTION

- A. After machine base grouting as specified under Section 11002, all machines mounted on baseplates or sole plates specified above shall be aligned as specified under this Section. Machines supported on integral feet or support pads shall be leveled, grouted and aligned in the following order: driven machine; intermediate bearings or machines; and driver. All machines shall be aligned without any connections to piping, electrical and instrumentation systems. Upon completion of all field connections, alignment shall be rechecked to demonstrate no change. If change has occurred, the CONTRACTOR shall eliminate any external forces affecting machine alignment and repeat the alignment process. All machine alignment parameters shall be rechecked after the equipment has been brought to operating temperature by operation at specified conditions. Where required by other sections in these Contract Documents, factory authorized installation technicians representing the equipment manufacturer shall witness final alignment work. All alignment work shall be independently checked using the shaft and coupling spool method described in Shaft Alignment Handbook. After completion of all alignment work and acceptance in writing by factory installation technicians, all machines shall be doweled in place using tapered stainless steel dowels. Alignment work shall be performed by journeyman millwrights skilled in this type of work under the supervision of a technician trained in the use of the laser alignment by the manufacturer of the alignment equipment. The use of laborers, carpenters or apprentices for this work shall not be acceptable. All final results of the alignment work shall be subject to inspection and verification by the CONSTRUCTION MANAGER.

****END OF SECTION****

SECTION 11373 – COMPRESSOR SYSTEM

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing a package oil-free rotary screw air compressor complete. The assembly shall be fully packaged, including air compressor, main drive motor, oil cooler, intercooler and aftercooler, separate motor driven lubrication system, regulation and control systems, all mounted on a common base frame and fully enclosed by a steel sound dampening enclosure.

1.2 RELATED SECTIONS

- A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

- 1. Section 11000 – Equipment General Provisions

1.3 SERVICES OF MANUFACTURER

- A. Inspection, Startup, and Field Adjustment: An authorized service representative of the manufacturer shall visit the site for not less than one day to furnish the indicated services.
- B. Instruction of OWNER'S Personnel: The authorized service representative shall also furnish the indicated services for instruction of the OWNER'S personnel in the operation and maintenance of the equipment including step-by-step troubleshooting procedures with necessary test equipment for not less than one day. Instruction shall take place separately from inspection, startup, and field adjustment.

PART 2 -- PRODUCTS

2.1 GENERAL - Compressors

- A. Operating Conditions: Compressor operating conditions shall be as follows:

Working Pressure (psig)	-	40-150
Compressor Capacity – FAD (scfm)	-	223
Discharge pressure (psig)	-	125
Motor size, min (hp)	-	60
Max compressor speed (rpm)	-	16123
Minimum Ambient Air Temp (°F)	-	15
Maximum Ambient Air Temp (°F)	-	115
Voltage	-	460
Phase	-	3
Frequency	-	60Hz

- B. The compressor shall be a positive displacement, two-stage rotary screw air compressor capable of delivering 100% oil-free air. There shall be no lubricants in the compression chamber. The assembly shall be fully packaged, including air compressor, main drive motor, oil cooler, intercooler and aftercooler, separate motor driven lubrication system, regulation and control systems, all mounted on a common base frame and fully enclosed by a steel sound dampening enclosure. Each compressor

shall be provided with a manual isolating valve adjacent to the equipment. The air compressor piping shall include flexible connectors as shown in the contract drawings.

- C. The compressor shall consist of two compressor stages connected to an integral speed increaser. Each stage is to be driven from a common bull gear to ensure optimum speed and high efficiency. There shall be an air-cooled intercooler between the first and second compression stages and an air-cooled aftercooler installed after the final stage.
- D. The capacity shall be expressed in terms of free-air delivery in actual cubic feet per minute (ACFM) measured at the discharge pressure and related back to inlet conditions. The capacity and shaft power shall be guaranteed per modified ASME PTC9. The ACFM and shaft power quoted shall be within the following tolerances:

Air Delivery + 4%
Power Consumption + 5%

- E. Compressor Unit:

Casing: The compressor air-end shall be a class 35 cast iron housing with precision manufactured, helical screw type rotors. The housing shall be air-cooled.

Rotors: Rotors and shafts shall be one-piece SUS420 stainless steel construction. Internal rotor cooling shall not be required. Rotors shall have an asymmetric profile to ensure high efficiency. Rotors shall be coated with MOS2 for sealing clearances. Rotors shall be dynamically balanced to guarantee vibration-free operation. Rotary lobe type compressors shall not be acceptable.

Timing Gears: Precision timing gears shall be manufactured of chromium molybdenum steel and be fitted to the rotor shafts and shall maintain precise rotor-to-rotor clearance. Gears shall be designed to assist in thrust canceling and absorb no more than 10% of input power under full load.

Bearings: Heavy duty anti-friction bearings with a minimum L-10 life of 50,000 hours. Anti-friction bearings shall be incorporated on each rotor. Radial loads shall be carried by straight roller bearings. Axial loads shall be carried by two sets of angular contact ball bearings.

Speed Increaser: A speed increaser shall be an integral part of the compressor unit and include the main drive shaft bull gear. The gear train shall be so designed to be thrust canceling.

Seals: The seals shall be restrictive ring type, self-adjusting and centering and constructed of stainless steel. The oil and air seal chambers shall be vented to atmosphere to prevent any possible contamination of the compressed air stream. Carbon seals shall not be acceptable.

Gaskets: All gaskets shall be asbestos free.

Coolers: The compressor cooling system shall be comprised of a separate motor driven fan and incorporate the following coolers:

1. Air-cooled oil cooler.
2. Air-cooled intercooler complete with moisture separator and automatic drain.
3. Air-cooled aftercooler complete with moisture separator and automatic drain.
4. The cooling fan shall be driven by a separate motor, starting and stopping with the oil pump for maximum cooling during start-up and shutdown.
5. All coolers shall be cross-flow aluminum construction to achieve maximum cooling efficiency and shall be rated for 150 PSIG at 500 degrees F. operating conditions.

Drive Motors: The main drive motor shall be horizontal ball bearing, NEMA design B with class B

temperature rise and class F insulation and energy efficient TEFC. The oil pump motor shall be (TEFC) C flange connected through a non-lubricated coupling for permanent shaft alignment. The cooling fan motor shall be totally enclosed fan-cooled (TEFC) for maximum service life.

Lubricating System: Lubrication oil for the compressor shall be contained in an integral sump. A separate direct driven gear type oil pump shall be provided to ensure positive lubrication at start-up when gear and bearing loads are at their peak. The drive gear, all bearings and timing gears in each stage shall be spray lubricated. All bearings and timing gears shall be pre-lubricated prior to startup and continue to be lubricated during shutdown. This time period for lubrication shall be monitored and controlled by the unit's internal control system.

Pressure Regulating System: The regulating system shall be a full load/no load type for maximum efficiency.

Control System: The control system shall be integral with the compressor package and shall consist of an electro-pneumatic regulator, designed to provide manual and automatic running. The capacity control valve shall be a disc type for trouble-free operation. The control system voltage shall be maximum of 115 volts, 60 Hz. The control system shall provide automatic shutdown of the compressor during periods of excessive idling.

The control system shall be controlled and monitored by a Allen Bradley Programmable Logic Controller (PLC). This controller will initiate and sequence the vents during start-up, operation, and shutdown. The PLC will monitor system functions, safety devices, and instrumentation. The PLC will incorporate an Erasable Programmable Read Only Memory (EPROM) for permanent program storage. This device shall enable control sequences to be changed on site or in the manufacturer's factory to meet future plant needs. The control system shall provide for the following:

1. Start oil pump to ensure positive lubrication prior to startup of the main drive motor.
2. Start cooling fan when oil pressure is established.
3. The compressor shall start unloaded and shall shut down unloaded, ensuring maximum component life.
4. The oil pump shall continue to run until the compressor stops.
5. Stop cooling fan motors 20 seconds after compressor is stopped to exhaust latent heat.
6. Dry contacts are provided for remote indication of power failure or fault conditions and run indication.
7. The control system shall provide automatic shut-off of the compressor if it remains unloaded for 10 minutes (to conserve energy) and shall automatically restart compressor on demand.
8. Service indication shall be provided when it is time to perform routine maintenance.
9. Shutdown indication shall occur with "first out" (first failure) feature when abnormal operating parameters are reached. Pre alarms shall be required for all temperature shutdowns.
10. Shall be adaptable to accept optional automatic or manual lead/lag control, sequencer control, automatic restart following power failure, remote start/stop control, or other controls as may be required for future plant needs.
11. Shall be expandable to automatically start dryers, pumps, cooling tower, or other remote devices.
12. Shall be capable of recording time and day of last 100 alarms/events.

Monitoring Equipment / Operator Interface: Operator interface shall be touch screen type with graphics, sunlight readable, 16 shades of gray or color to read compressor data easily. Three configurable graphs for historical trending shall be standard.

Minimum required devices:

1. First-stage discharge air pressure display.

2. Second-stage discharge air pressure display.
3. Oil pressure display.
4. Air inlet filter service indicator.
5. Digital first-stage discharge air temperature display.
6. Digital second-stage air inlet temperature display.
7. Digital second-stage discharge temperature display.
8. Digital aftercooler outlet air temperature display.
9. Digital oil temperature display.
10. Low oil pressure indicator.
11. Running time display.
12. Loaded time display.
13. Standby light.
14. Power-on light.
15. Motor overload indication.
16. Compressor run light.
17. Oil pump run light.
18. Fan run light.
19. Load light.
20. Manual unload button.
21. Oil level gauge.
22. Oil filter condition indicator.
23. Alarm buzzer.
24. Lamp test switch.
25. Buzzer cancel switch.

Safety Devices: Compressor shall have automatic shut-off devices for the following conditions:

1. Low oil pressure.
2. High outlet air pressure.
3. High first-stage discharge air temperature.
4. High second-stage inlet air temperature.
5. High second-stage discharge air temperature.
6. High outlet air temperature.
7. High oil temperature.
8. Compressor motor overload.
9. Lube oil pump motor overload.
10. Cooling fan motor overload.
11. High cabinet temperature.
12. Main starter failure.

The unit shall automatically stop, annunciate by alarm bell, and indicate the appropriate failure by alarm and text display. Alarm bell must remain on until manually reset.

Filter System: Air intake filters are to be enclosed in package and easily accessible for service. Air entering the compressor shall be drawn from outside the package. Filters shall be paper cartridge type. 5 micron - 99% or greater efficiency.

Compressor Enclosure:

1. The compressor unit, including motor, shall be enclosed in a steel sound insulating canopy with doors to provide ready access for normal maintenance.
2. The doors shall be removable. Enclosure and base frame to be painted for long life and durable finish.

3. Sound insulating material shall be nominal 2 pounds per cubic foot polyether foam with UL94HP-1 flame resistance. Sound insulating material shall be 1 inch thick.
4. Enclosure shall be ventilated using a separate motor driven fan starting when oil pressure is established and stopping 20 seconds after the compressor stops.
5. The compressor shall be designed so that the installation is simplified. No special foundations are required other than those necessary to support the weight of the unit. The unit shall be delivered with all internal compressed air and oil piping, and wiring complete. There shall be a 2-source hook-up for utilities, one for air discharge and one for incoming electrical service. All automatic drain lines shall be brought out of the cabinet for ease in connecting to floor drain.

2.2 NAMEPLATES, TOOLS AND SPARE PARTS

A. Nameplate: Nameplates shall be included on all air compressors, air dryers, and air receivers and shall be stainless steel engraved attached to units with stainless steel hardware and affixed to units per manufacturer's recommendation. Air filters shall be marked with round stainless steel tags with engraved valve names/numbers and attached with stainless steel hardware.

B. Spare Parts: The WORK includes the following spare parts:

1. 2 sets of all gaskets, O-rings and washers
2. 1 set of all piston rings
3. 2 sets of drive belts
4. 4 sets of all intake filter elements

2.3 MANUFACTURERS

A. Compressors of the type or model indicated shall be manufactured by one of the following (or equal):

1. Kobelco
2. Ingersoll-Rand

2.4 Appurtenances

- A. Lead/lag control for 2-machine operation.
- B. Auto restart after power failure.
- C. Isolating valves for drains, unions for threaded piping, or other items as required for a complete and operational system shall be provided.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General: The compressors with all the auxiliary equipment shall be installed in accordance with the manufacturer's written instructions.

3.2 FIELD TESTING

A. Field testing of the compressors shall be performed as follows:

1. The units shall be started and stopped several times and checked for proper operation without excessive vibration and overheating.

2. The setting of all pressure switches, relief valves, and pressure reducing valves shall be verified and adjusted with the pressure gauges. The automatic starting and shutoff functions shall be checked as well as the functioning of the condensate traps.

**** END OF SECTION ****

SECTION 13300 - INSTRUMENTATION AND CONTROL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes the general specification and requirements for the instrumentation and control WORK under this and other applicable Specifications. The WORK also includes providing instrumentation and all related wiring as shown in these Contract Documents.
- B. All DCS programming shall be provided by the CITY. The CONTRACTOR is responsible for a complete and functional system. The CONTRACTOR shall meet the functionality, intent, and requirements provided in the control strategies, equipment specific specification, control diagrams, P&ID's, Commissioning, and all other related Contract Documents. Not all information is explicitly provided in each of these documents, but all of the Contract Documents as a whole constitute the requirements to be provided by the CONTRACTOR. It is the intent of the Contract Documents to show information once, and not to repeat that information again and again throughout all the other related documents. The CONTRACTOR is responsible for providing their subs with all the required information.
- C. The CONTRACTOR shall be responsible for the design, procurement, installation, testing, training, and documentation for instrumentation and control systems provided under this Contract. The CONTRACTOR shall be responsible for installing and terminating DCS inputs and outputs (I/O), providing power, data links to the DCS, and for installing and testing all equipment.
- D. The CONTRACTOR shall be responsible for providing instrument submittals to be used in the generation of panel wiring diagrams and loop drawings which depict the interconnection between all devices shown in the Contract Documents.
- E. The CITY will incorporate the CONTRACTOR's data and generate complete loop drawings for each measuring or control loop. The loop shall include a minimum of 3 sheets as required in paragraph 1.5 B.3. The CONTRACTOR shall furnish redlines for the Project-wide Loop Drawing Submittal (PLDS) that completely defines and documents the contents of each monitoring, alarming, interlock, and control loop associated with equipment provided under the instrumentation sections, and equipment provided under sections in other Divisions.
- F. The CONTRACTOR is responsible for providing a complete and functional system. The CONTRACTOR and their associated vendors shall provide input, coordination, and oversight with regards to the CITY provided DCS programming.
- G. All control system field tests including loop tests, plant commissioning, and plant startup, shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall provide competent personnel including electrical engineer, I&C engineer, and process engineer during all field tests. The CONTRACTOR shall be responsible for providing field and control room personnel to witness the simulation of field inputs associated with the DCS I/O and points that are data linked to the DCS. The CONTRACTOR shall be responsible

for providing all competent personnel and NIST certified, current within a year, equipment (current drivers, jumpers, read out devices, oscilloscopes, voltage-resistance meters, etc.) required to perform the loop test simulations. All devices used shall be traceable to the National Institute of Standards and Technology (NIST).

- H. The CONTRACTOR shall perform field engineering design as required for mounting and supporting all field mounted components. The CONTRACTOR shall develop any additional schematic and interconnection diagrams which may be required for complete and operable instrumentation.
- I. The CONTRACTOR shall provide all components, system installation services, as well as all required and specified ancillary services in connection with the I&C system. The system includes all materials, labor, tools and documentation required to furnish, install, test and place in operation a complete and operable I&C system as shown and/or specified in the contract drawings. The CONTRACTOR shall include, but is not limited to, witnessing the functional testing of all control loops ensuring instruments and wiring for each loop have been correctly installed. The CONTRACTOR shall also ensure, amongst other tasks that, all wires are correctly numbered, drawings are correctly updated and within the required time frame and that all parties concerned work to the project time line to meet project milestones. During commissioning the CONTRACTOR shall coordinate between the relevant subcontractors to ensure that the necessary stage of completion is reached by all involved parties and all functional tests have been performed satisfactorily before that particular phase of the project is scheduled for commissioning. This shall include polarity and functional tests of all field devices, all data communication links are functional and all devices being controlled and monitored are adequately represented on the graphic display including any associated functions, which may be required.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Division 11 Equipment, as applicable
 - 2. Division 15 Mechanical, as applicable
 - 3. Division 16 Electrical, as applicable

1.3 CODES

- A. WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. Uniform Fire Code
 - 2. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B 16.5 Pipe Flanges and Flanged Fittings

API RP-550	Manual on Installation of Refinery Instruments and Control Systems, Part 1 - Process Instrumentation and Control Sections 1 Through 13
ASTM A 105	Specification for Forgings, Carbon Steel for Piping Components
ASTM A 193	Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars
ASTM A 312	Stainless Steel Piping
ISA-RP60.6	Nameplates, Labels, and Tags for Control Centers
ISA-RP7.1	Pneumatic Control Circuit Pressure Test
ISA-RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
ISA-S5.1	Instrument Symbols and Identification
ISA-S5.4	Instrument Loop Diagrams
ISA-S12.4	Instrument Purging for Reduction of Hazardous Area Classification
ISA-S20	Specification Forms for Process Measurement and Control Instrumentation; Primary Elements and Control Valves
ANSI - B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 In Through 144 In.
ANSI/AWWA C701	Cold-Water Meters - Turbine Type for Customer Service
ANSI/AWWA C702	Cold-Water Meters - Compound Type
AWWA C704	Cold-Water Meters - Propeller Type for Main Line Applications
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
ASTM B 61	Specification for Steam or Valve Bronze Castings
ANSI/AWWA	Ductile-Iron and Gray-Iron Fittings, 3-In Through C110/A21.10 48-In for Water and Other Liquids
ASME REPORT	Fluid Meters, Sixth Edition, 1971

1.5 SHOP DRAWINGS AND SAMPLES

A. Presubmittal Conference:

1. The CONTRACTOR shall arrange and conduct a Presubmittal Conference within 60 days after award of the Contract. The purpose of the Presubmittal Conference is to review and approve the manner in which the CONTRACTOR intends to carry out his responsibilities for shop drawing submittal on the WORK to be provided under this Section. The CONTRACTOR and the CONSTRUCTION MANAGER shall attend. Both the CONTRACTOR and the CONSTRUCTION MANAGER may invite additional parties at their discretion.
2. The CONTRACTOR shall allot one, 4-hour day for the Conference

3. The CONTRACTOR shall prepare the following for discussion at the Conference:
 - a. List of equipment and materials for the instrumentation systems, including proposed manufacturer names and model numbers.
 - b. List of proposed clarifications to the indicated requirements plus a brief written explanation of each exception.
 - c. One complete example of each type of submittal proposed.
 - d. A flow chart showing the steps the CONTRACTOR will take in preparing and coordinating each submittal to the CONSTRUCTION MANAGER.
 - e. A bar chart type schedule for the WORK provided under this Section, covering the time period beginning with the conference and ending after startup and training. Dates for the beginning and ending of submittal preparation, submittal review, design, fabrication, programming, factory testing, delivery to the site, installation, field testing, and training shall be scheduled. The schedule shall be subdivided into major items or groups of items which are on the same schedule.
4. The CONTRACTOR shall furnish 3 copies of all the items above to the CONSTRUCTION MANAGER.
5. The CONTRACTOR shall take formal minutes of the Conference, including all events, questions, and resolutions. Prior to adjournment, all parties must concur with the accuracy of the minutes and sign accordingly.

B. Shop Drawings:

1. **General:**
 - a. Preparation of shop drawings shall not commence until adjournment of the Presubmittal Conference.
 - b. Preliminary Shop Drawings shall be submitted as a single package at one time within 90 days of the commencement data stated in the Notice to Proceed.
 - c. Both paper (hard copy) and electronic copies are required for both Preliminary and Final Shop Drawing submittals.
 - d. In the Contract Documents, all systems, meters, instruments, and other elements are represented by symbology derived from the latest version of ANSI/ISA S5.1. The nomenclature and numbers indicated herein shall be used exclusively in all shop drawings. No manufacturer's standard symbology or nomenclature shall replace those indicated in the Contract Documents.
 - e. During the period of shop drawing preparation, the CONTRACTOR shall maintain a direct, informal liaison with the CONSTRUCTION MANAGER for exchange of technical information. As a result of the exchange, certain

minor refinements and revisions to the indicated systems may be authorized informally by the CONSTRUCTION MANAGER but these shall not alter the WORK or cause increase or decrease in the Contract Price. During informal exchanges, no statement by the CONSTRUCTION MANAGER shall be construed as approval of any component or method or exception to or variation from these Contract Documents.

2. Submittals:

- a. Preliminary Submittal: Four hard copies of the preliminary submittal shall be provided for the City's review. Documents in a PDF format shall also be provided.
- b. Final Submittal: All documents, including design and O&M documents, shall be provided on CD-ROM. One set of CD-ROMS shall contain the native file formats (MicroStation, MS Word, MS Excel, etc.), and the other in PDF format, using the same file name with "PDF" or "TIF" as the file extension. Four hard copies of the final submittal shall be provided as well as a pdf copy.
- c. Each document shall be indexed, and a database table in Excel shall be provided which includes the following data for each document
 - (1) Document file name
 - (2) Document description
 - (3) Hard Copy Catalog No. (used by facility document coordinator)
 - (4) Document Type:
 - (a) Shop drawings
 - i) P&IDs
 - ii) Loop Drawings
 - iii) Instrument Data Sheets
 - iv) Other
 - (b) Manufacturer's data
 - (c) Maintenance instructions
 - (d) Training
 - (5) Facility Name
 - (6) Specification Number
 - (7) Process Name
 - (8) Unit Process Number
- d. Electronic Document Submittal Requirements:

- (1) All documents shall be submitted in electronic format, including shop drawings manufacturer's data and O&M manuals.
 - (2) Documents shall be in Adobe Acrobat PDF format, version as specified by the Contract Manager. Vendor and Contractor shop drawings developed under the Contract shall be in Bentley MicroStation (.DGN) format. Documents in electronic format (Microsoft Word, Excel, etc.) shall be electronically converted to standard PDF format. In order to minimize file size, drawing conversion from MicroStation files to Acrobat PDF shall be in monochrome.
 - (3) Deviation from this standard will be accepted only if advance approval is given by the Owner
 - (4) Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) for documents without graphics, or 150 dpi color for documents with graphics where color is required for legibility, and converted into Adobe Acrobat (PDF). Scanned image enhancement software shall be used. PDF sub-format shall be full Image + Hidden Text PDF file format.
 - (5) All PDF documents shall be reviewed, and corrected if necessary, for orientation and legibility.
 - (6) Individual document files shall not exceed 3 megabytes in size.
- e. Paper Document Submittal Requirements

- (1) All shop drawings shall include the letterhead or title block of the CONTRACTOR. The title block shall include, as a minimum, the CONTRACTOR registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing.
- (2) Shop drawing copies shall be submitted as standard size 3-ring, loose-leaf, vinyl plastic binders suitable for bookshelf storage. Maximum binder size shall be 2 inches.
- (3) A complete index shall be placed at the front of each binder.
- (4) A separate technical brochure or bulletin shall be included for each instrument, meter system, and other element. The brochures shall be indexed by systems or loops. If, within a single system or loop, a single item is employed more than once, one brochure may cover all identical uses of that item in the system. Each brochure shall include a list of tag numbers to which it applies. System groups shall be separated by labeled tags.
- (5) All shop drawings shall be produced in using MicroStation CAD formats. Each shop drawing submittal shall include the requisite number

of hard copies and one (1) MicroStation electronic copy. Upon completion of this project, the Contractor shall submit four (4) electronic copies of all current shop drawings.

3. **Loop Diagrams:** The CITY will provide the necessary drafting based on the CONTRACTORS redlines. The CONTRACTOR shall be responsible for the accuracy of the information within the loop drawings. Upon completion of the CITY's loop drawings, the CONTRACTOR shall review and upon satisfaction of the accuracy of the documents shall provide a letter to the OWNER stating that the loop drawings properly reflect the projects as-built condition. Sample loop drawings are provided at the end of this Section in *Appendix B – Sample Loop Drawings*. The PLDS shall be a singular complete bound package submitted 80 days prior to SUBSTANTIAL COMPLETION. Loop diagrams shall be provided conforming to ISA 5.4 to verify the DCS interfaces with all instrumentation and devices being provided or installed under the project. The loop diagrams shall also define all interfaces with equipment provided by area Contractors. The following three-sheet format is required:

- a. Sheet 1: A device schedule developed from an electronic spreadsheet or database file, which will be submitted with the loop diagrams. The table will show the following:

- (1) Device tag number, with Prefix, Unit Process, ISA Tag Prefix, Tag No. (a three or four-digit number based on the loop number) and Tag suffix
- (2) Equipment Service
- (3) Device Type
- (4) Location
- (5) Device Manufacturer
- (6) Model No.
- (7) Spec. No.
- (8) Area Contractor (if applicable)
- (9) Submittal No.
- (10) Calibrated Range/Remarks
- (11) Data Sheet No.
- (12) I/O Signal type (AI, AO, DI, or DO)
- (13) Signal Level
- (14) Device Range (full available instrument range)

- (15) Engineering Units
 - (16) Process Set Point
 - (17) Loop Diagram No., reflecting the field instrument tag number.
 - (18) Loop Drawing File Name
 - (19) Interconnect Drawing File Name
- b. Sheet 2: Loop drawing meeting the Requirements of ANSI/ISA S5.4, except that intermediate terminal junction boxes may be omitted and be shown on Page 3 for clarity. Butt splices and wire nuts shall be shown on as-builts, with the corresponding termination housing (JB, LB, etc. shown on Sheet 3).
 - c. Sheet 3: (Expansion sheet - required if the number of intermediate devices or terminal junction boxes exceeds what can be legibly shown on Sheet 2). Abbreviated diagram showing instrument, wire and cable numbers, intermediate terminal junction boxes, and PCM terminations. Wire identification numbers will reflect the field instrument tag number, and not the DCS I/O number.
 - d. DCS I/O tag numbers will generally reflect the device tag number. Each I/O tag number will be unique. The tag prefix will be based on ISA-5.4, with the following additional special acronyms:

Acronym	Signal Use
YL	Ready Signals/ Status
ZL	In Computer status
ZSO	Device Open
ZSC	Device Closed
YL	Motor Run
HS	Equipment Start/Stop

- 4. **Technical brochures, bulletins and data sheets containing:**
 - a. Fully completed ISA S20 data sheets
 - b. Component functional descriptions
 - c. Locations or assembly at which component is to be installed
 - d. Materials of a component's parts which will be in contact with process fluids or gases

5. Schematic and wiring diagrams for control circuits shall be submitted in two stages. Initially, schematic control diagrams shall show complete details on the circuit interrelationships of all devices within and outside each Control Panel. Subsequent to acceptance of all schematic control diagrams, by the CONSTRUCTION MANAGER, piping and wiring diagrams shall be submitted. The diagrams shall consist of component layout drawings to scale, showing numbered terminals on components together with the unique number of the wire to be connected to each terminal. Piping and wiring diagrams shall show terminal assignments from all primary measurement devices, such as flow meters, and to all final control devices, such as pumps, valves, chemical feeders and local control panels. Wiring diagrams shall include MCC Panel, circuit, and breaker number for each power feed
6. Assembly and construction drawings for each alarm annunciator, local indicating panel and for other special enclosed assemblies for field installation. These drawings shall include dimensions, identification of all components, surface preparation and finish data, and nameplates. These drawings also shall include enough other details, including prototype photographs, to define exactly the style and overall appearance of the assembly; a finish treatment sample shall be included.
7. Installation, mounting, and anchoring details for all components and assemblies to be field-mounted, including conduit connection or entry details.
8. Complete control panel layouts, all drawn to a 1-1/2 inch=1 foot scale showing:
 - a. Physical arrangements which define and quantify the physical groupings of annunciators, hand stations, recorders, indicators, pilot lights and all other instrumentation devices associated with control panel sections, auxiliary panels, subpanels and racks.
 - b. All cutout locations fully dimensioned. All outside panel dimensions shall be shown.
 - c. Locations of back-of-panel stiffeners.
 - d. Terminal point locations for all panel and back-of-panel piping and wiring connections. Terminations shall be coded with identifiers for wiring and piping connections for all electric, hydraulic and pneumatic terminations.
 - e. Nameplate engraving list.
 - f. A complete and detailed bill of material list shall be submitted for each field mounted device or assembly as well as cabinet assemblies and subassemblies. Bills of material shall include all items within an enclosure. An incomplete submittal shall be rejected and no further evaluation performed until a complete and detailed bill of material is submitted

1.6 OWNER'S MANUAL

- A. The Owner's Manual shall be submitted in both paper and electronic format. Electronic format shall conform to the Electronic Document Submittal Requirements for Shop Drawings.

B. Information included in the OWNER'S MANUAL:

1. Two copies of the OWNER'S MANUAL shall be submitted after acceptance of all submittals under Paragraph 1.5. One set will be returned to the CONTRACTOR with comments.
2. Final copies of the OWNER'S MANUAL, after revisions, shall be submitted to the CONSTRUCTION MANAGER 15 days prior to startup.

C. The following shall be included in the OWNER'S MANUAL:

1. Installation, connection, operating, troubleshooting, maintenance, and overhaul instructions from the manufacturer.
2. Exploded or details views of all instruments, assemblies, and accessory components.
3. Parts lists and ordering instructions.
4. Wiring diagrams.
5. A list of spare parts for 1 year operation recommended by the manufacturers of all analog equipment.

1.7 AS-BUILT DRAWINGS

A. As-built drawings shall be prepared with the following exceptions and changes:

1. The CONTRACTOR shall keep current an approved set of complete loop diagrams and schematic diagrams which shall include all field and panel wiring, all piping and tubing runs, all routing, all mounting details, all point-to-point diagrams with cable, wire, tube and termination numbers. These drawings shall include all instruments and all instrument elements for the complete instrument loop as provided under Divisions 11, 13, 14, 15, and 16 of this Contract.
2. One set of original drawings and two copies of each as-built drawing under this Section shall be submitted to the CONSTRUCTION MANAGER after completion of field checkout but before placing the systems in service for the OWNER'S use.
3. Drawings shall also be submitted in electronic format (MicroStation)

1.8 SERVICES OF MANUFACTURER

A. **Calibration, Testing and Startup:** A technical service representative of the manufacturer shall visit the site and perform the following on all devices.

1. Inspection, checking and calibrating the equipment.
2. Startup and field testing for proper operation.
3. Performing field adjustments to ensure that installation and operation comply with the Specifications.

- B. **Instruction of OWNER'S Personnel:** The manufacturer's technical service representative shall instruct the OWNER'S personnel as indicated in Paragraph 3.4.

1.9 SPECIAL GUARANTEE

- A. The CONTRACTOR shall guarantee the WORK of this section for two years following final acceptance of the WORK. In making any warranty repairs, the CONTRACTOR shall utilize technical service personnel designated by the manufacturer of the failed device. Repairs shall be completed within 5 days after written notification by the OWNER.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Products delivered to the site for incorporation into the WORK of this Section shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.
- B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

1.11 CABLE NUMBERING

- A. The first two characters denote the facility or area number.
- B. The second group of characters identifies the device being served.
- C. The third section uses one of the four suffixes in the table below. Where multiple circuits of the same type are routed to the same endpoint, the suffix will be P1, P2, as required.
- D. At each device or termination point, the circuit identification number is appended with the individual wire number. For Direct-Current (DC) circuits only, wire polarity is shown in parentheses as (+) or (-).
- E. Spaces are not allowed, and letters are not case-sensitive, and written in upper case.

SUFFIX	CIRCUIT TYPE	EXAMPLE
(A)	24 v dc analog (4-20 mA)	01FIT022(A)-1(+)
(C)	120 volt AC control	05P320(C)-2
(D)	24v dc digital status or control	55LSH201(D)-1(+)
(P)	Power (120 volt, 480 V, 5 KV, 15 KV, etc.)	01MCC6101(P)-2

PART 2 -- PRODUCTS

2.1 GENERAL

- A. All meters, all instruments, and all other components shall be of the most recent field-

proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise indicated.

- B. Panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.
- C. Outdoor instrumentation shall be suitable for operation in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation in order to maintain it within its rated environmental operating ranges. The CONTRACTOR shall provide all power wiring for these devices. Outdoor enclosures suitable for the environment shall be provided.
- D. All instrumentation in hazardous areas shall be intrinsically safe or be approved for use in the particular hazardous classification in which it is to be installed.
- E. Mercury switches and components containing liquid mercury shall not be used.
- F. Analog measurements and control signals shall be electrical and shall vary in direct linear proportion to the measured variable, except as indicated. Electrical signals outside control board(s) shall be 4 to 20 milliamperes DC except as noted. Signals within enclosures shall be 1-5 volts DC unless otherwise specified. Dropping resistors shall be installed at all field side terminations in the control panels to ensure loop integrity.
- G. The accuracy of each instrumentation system or loop shall be expressed as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of ± 0.5 percent of full scale and a minimum repeatability of ± 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.
- H. Each control loop shall be individually fused.
- I. **Color Conventions:** Lens covers for indicating lights on all panels will be colored as follows:
 - 1. Red-ON when;
 - Motor not running (STOPPED)
 - Valve CLOSED (not fully opened)
 - Device not energized.
 - Circuit breaker OPENED
 - 2. Green-ON when;
 - Motor running in forward direction (fast speed for multi-speed motors).
 - Valve OPEN (not fully closed)
 - Device energized.
 - Circuit breaker CLOSED

3. White-ON when;
 - Power available
 - System in AUTOMATIC mode.
 - Monitoring taking place.

4. Amber-ON when;
 - Malfunction trip.
 - Equipment locked out.
 - Alarm condition

J. **Nameplates:** Nameplates shall be provided for instruments, function titles for each group of instruments, and other components mounted on the front panel(s) as indicated. A nameplate shall be provided for each signal transducer, signal converter, signal isolator, and electronic trip mounted inside the panel(s). Nameplates shall be descriptive to define the function and system of such element. These nameplates shall be of the same material as those on the front of the panel(s). Adhesives shall be used for attaching nameplates. Nameplates shall be fabricated from black face white-center laminated engraving plastic. Painted surfaces shall be prepared to allow permanent bonding of adhesives. Colors, lettering, styles, abbreviations and sizes shall be in conformance with ISA-RP60.6 with an intended viewing distance of 3 feet to 6 feet.

K. **Factory Inspection:**

1. Panels shall be inspected for compliance with requirements at the factory before shipment to the site. The CONTRACTOR shall notify the CONSTRUCTION MANAGER 2 weeks in advance of the testing date. A representative of the CONSTRUCTION MANAGER will visit the factory to make the inspection.
2. CONTRACTOR shall perform the following tests prior to arrival of the CONSTRUCTION MANAGER:
 - a. All alarm circuits rung out to determine their operability.
 - b. Electrical circuits checked for continuity and where applicable, operability.
 - c. Nameplates checked for correct spelling and correct size of letters.
 - d. Other test required to place the panel in an operating condition.
3. It shall be the responsibility of the CONTRACTOR to furnish all necessary testing devices and sufficient manpower to perform the tests required by the CONSTRUCTION MANAGER to determine conformance to the requirement of the Contract documents.
4. If the above tests have not been performed prior to the arrival of the CONSTRUCTION MANAGER, the CONTRACTOR shall reimburse the OWNER for the cost of the extra time required for the inspector's services and travel expenses.

L. **Shipment:**

Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments which are shipped with the panel shall have suitable shipping stops and cushioning material installed to protect instrument parts from mechanical shock damage during shipment. Each panel crate shall be provided with removable lifting lugs to facilitate handling

2.2 ELECTRICAL REQUIREMENTS FOR CONTROL PANELS

- A. The CONTRACTOR shall provide all wiring, conduit, wireways, and switches required to make instruments and other panel electrical devices operational. Conduit, wireways, junction boxes and fittings shall be installed for all signal wire, all thermocouple and resistance thermometer lead wire including those between temperature sensors and temperature indicators.
- B. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. All wiring shall be identified with stamped tubular wire markers.
- C. Smaller panels shall be sized to adequately dissipate heat generated by equipment mounted in or on the panel.
- D. Where smaller panels are mounted outside or in unshaded areas, they shall be provided with thermostatically controlled heaters capable of maintaining inside temperatures above 40 degrees F.
- E. **Wiring Methods:** Wiring methods and materials for all panels shall be in accordance with the NEC requirements for General Purpose unless otherwise indicated. Opening wiring in close cabinet type panels is allowed when indicated.
- F. **Construction:**
1. Wire for 115-volt circuits shall be No. 14 AWG stranded with Type THWN or THHN insulation. All terminals for external wiring connections shall be suitable for No. 12 AWG wire.
 2. Flexible conduit is not acceptable.
 3. Conduit fittings shall be cast fittings.
 4. Soldered or pressure crimped wire splicing in conduits shall be acceptable.
 5. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground buss completed with solderless connector for one No. 4 AWG bare stranded copper cable. The CONTRACTOR shall connect the copper cable to a system ground loop.
 6. Single case annunciator units with no remote logic which are installed at the top of a panel may be considered as being a terminal box when top of panel wire entry is indicated. If bottom of panel entry is indicated, terminal box shall be provided at

the bottom of the panel and wired to the annunciator. Terminals shall be identified with plastic marker strips.

7. Terminal boxes for incoming and outgoing signal leads shall be located at the top or bottom of the panel as indicated or as otherwise required.

G. Power Supply Wiring:

1. Unless otherwise indicated, all instruments, all alarm systems, and all motor controls shall operate on 24 VDC circuits.
2. The CONTRACTOR shall furnish terminal box connections for the main power supply entry as indicated.
3. Instruments located on a single panel section which serve one process unit may be connected to a common branch power circuit. The number of branch circuits shall be such that no circuit load exceeds 10 amps. Different panel sections and instruments serving different process units shall not use common branch circuits. A 15-amp, two-pole circuit breaker shall be provided in each branch circuit. When instruments do not come equipped with integral fuses, the panel fabricator shall furnish and install fuses as required for the protection of individual instrument against fault currents. Fuses shall be mounted on the back of the panel, in a fuse holder, with each fuse identified by a service name tag.
4. Each potentiometer type instrument, electronic transducer, controller or analyzer shall have an individual disconnect switch. Disconnect switches shall have metal or plastic tags listing the associated instrument tag numbers. Individual plug and cord set power supply connections may be used without switches when indicated.
5. Where alarm units are single unit types, one switch may be used to disconnect not more than six alarm units located on the same or adjacent panels.

6. Signal Wiring:

- a. Computer and Non-Computer Use: Signal wire shall be twisted shielded pair or triads in conduit or troughs. Cable shall be constructed of No. 16 AWG copper signal wires with THWN or THHN insulation. Color code for instrument signal wiring shall be:

- (1) Positive - Black (+)
- (2) Signal Ground Negative - White (-)
- (3) Equipment Ground - Green
- (4) Ungrounded - Red
- (5) Energized by voltage sound external to panel - Yellow
- (6) DC circuit - Blue

- b. Multiconductor cables where indicated shall consist of No. 16 AWG copper signal wires twisted in pairs, with 600 volt fault insulation. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.
 - c. Multi-conductor cables, wireways and conduit shall provide for 10 percent allocation of spare, unused signal wires in addition to the indicated requirements.
- H. **Terminal Blocks:** Terminal blocks shall be molded plastic with barriers and box lug terminals, and shall be rated 15 amperes at 600-volts. White marking strips, fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid.

2.3 GENERAL INSTRUMENTATION ENCLOSURE COMPONENTS

- A. **Signal Isolators, Converters, and Power Supplies:** Signal isolators shall be provided in each measurement and control loop, wherever required, to match adjacent component impedances, or where feedback paths may be generated or to maintain loop integrity when the removal of a component of a loop is required. Signal converters shall be provided where required to resolve any signal incompatibilities. Signal power supplies shall be provided to supply sufficient power to each loop component.
- B. **General Purpose Relays:** General purpose relays in the Control Panels shall be plug-in type with contacts rated 10 amperes at 120 volts ac; quantity and type of contacts shall be as indicated. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover. Sockets for relays shall have screw type terminals.
- C. **Time Delay Relays:** Time delay relays shall be electronic on-delay or off-delay type with contacts rated 10-amperes at 120-volts AC. Units shall include adjustable dials with graduated scales covering the indicated time range.

2.4 CONTROL PANEL INSTRUMENTATION

- A. **Selector and Pushbutton Switches:** Selector and pushbutton switches shall be rated 10 A at 600 volts, shall be heavy-duty, oil-tight, and shall have the number of positions and poles indicated. Operators shall be corrosion resistant.
- B. **Indicating Lights:** Indication lights shall be LED push-to-test type and shall be heavy-duty, oil-tight. Each light shall have a screwed-on glass lens approximately 1-inch in diameter. Each light shall have a factory-engraved legend plate as indicated. Indicating lights shall be 120 VAC type with transformers for use with LED.

2.5 FLOW DETECTION SWITCHES

- A. **Thermal Flow Switches:** Flow switches shall be thermally activated based on heat transfer between probes in the pipe flow stream. The probes, electronic circuits and relay shall all be part of an integral unit with a non-ferrous cast housing. Process wetted parts shall be 316 stainless steel. In horizontal pipe runs the unit shall be side mounted. All

switches shall be equipped to function in an environment where the probes are not always immersed. Output relay shall be configurable to energize on increasing decreasing flow and have DPDT contacts rated 8 Amps @ 240 Vac minimum. Contact transfer point shall be field adjustable from .015 to 5 ft/sec in water. Response time shall be adjustable from 1 to 150 seconds. The trip flow point shall not be affected by process fluid changes in the range of 32 to 140 degrees F and shall have a repeatability of ± 5 percent. The contract unit shall operate with the specified repeatability in an ambient temperature range of 25 to 120 degrees F. The power supply shall be 120 Vac. Unit shall be provided with a retractable probe and packing gland designed by the manufacturer to remove and service the meter while the process is under pressure, up to 50psig. The Contractor shall provide appropriate bushings or flanges and stainless steel ball valves for the process connections approved by manufacturer for installation and corresponding probe insertion length to suit. Unit shall be Factory Mutual Research Corp (FRMC) approved. Contractor shall calibrate the instrument per the manufacturer's recommendations and the settings provide in the Contract Documents. Manufacturer shall be ABB or approved equal.

2.6 PRESSURE MEASURING SYSTEMS

- A. **Annular Ring Seals for Pressure Measuring Systems:** Where seal elements are used to isolate pipeline flow media from a gauge the sensor shall be flanged and bolted directly into ANSI flanged pipelines. Face to face shall not be greater than a wafer style of a butterfly valve. The flanges shall have thru bolt holes to enable positive alignment in the pipeline. Flanges shall conform to pipe specifications. Inside diameter of the sensor shall be the same as the mating pipe with a full thru uninterrupted flow. There shall be no dead ends or crevices and flow passage shall make the sensor self-cleaning. Wetted parts (liner) shall be capable for continuous duty handling a slurry containing up to 15% solids. The Pressure Sensing Ring shall measure pressure for 360 degrees around the full inside circumference of the pipeline. The sensing ring shall also be clamped into the body for the full radial width of the sensor. Pressure shall be transmitted to the gauge by a locked in and sealed fluid such as ethylene glycol or silicone oil. The sensor shall have an auxiliary tapped and plugged port to allow connection or other equipment. Manufacturer shall be Red Valve Company, Inc. Ronningen-Petter, or approved equal.
- B. **Diaphragm Piston Pressure Switches:** Pressure switches shall consist of a pressure transducer and a precision switch. Pressure transducer shall be the diaphragm piston type with wetted materials as recommended by the switch manufacturer. Piston shall be backed by a cylinder disc to permit 10 times over range pressure without affecting calibration. Range spring and piston shall be isolated from process fluids by the diaphragm. Switch shall be provided with two 3/4-inch conduit connections. The pressure transducer shall be selected so that setpoint falls between 30 and 70 percent of maximum range. Approximate setpoint and, if applicable, reset point shall be indicated on calibrated scales. Repeatability and sensitivity shall be 1.0 percent of operating range or better. Unless otherwise specified, switches shall be non-adjustable deadband type.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. The CONTRACTOR shall employ installers who are skilled and experienced in the installation and connection of all elements, all instruments, all accessories, and all assemblies provided under this Contract.
- B. The CONTRACTOR shall install all instruments according to the manufacturer's installation instructions and the following:
 - 1. Perform field engineering as required for mounting and supporting all field mounted components.
 - 2. Prepare any additional schematic and interconnection diagrams required for installation.
 - 3. Assemble and interconnect instrument components disconnected for shipping purposes.
 - 4. Remove all temporary supports, bracing, and padding inserted in instrument control panels and other equipment to prevent damage during shipping, storage, or installation.
 - 5. All piping shall be field measured prior to fabrication and erection. Any significant discrepancies between drawings and field conditions shall be reported to the CONSTRUCTION MANAGER. The OWNER will not be responsible for any costs to the CONTRACTOR for rework because of CONTRACTOR failure to take measurements prior to fabrication.
 - 6. Adequately support and protect capillary tubing. All extra tubing shall be carefully coiled, tied, and protected at the instrument location.
- C. It is the intent of the Contract Documents that all wiring external to Control Panels be provided under the requirements of Division 16. Further, it is the general intent that all 4-20 mA signal circuits, process equipment control wiring, signal wiring to field instruments, and Control Panel input and output wiring, be provided under Division 16 and be terminated and identified under Division 13.
- D. The CONTRACTOR's attention is directed to the electrical and mechanical schematics and details of this project. Referral to these portions of the Contract Documents shall be required in order to understand the full intent and scope of work required.
- E. Monitoring and control system configurations are diagrammatic only. Locations of equipment are approximate unless dimensioned on the drawings. Exact locations and routing of wiring and cables shall be governed by structural conditions, physical interferences, and locations of electrical terminations on equipment.
- F. Where job conditions require minor changes in approximated locations and arrangements, the CONTRACTOR shall make such changes without additional cost to the OWNER.
- G. All instruments shall be located and installed for ready access by the OWNER'S operation and maintenance staff. The OWNER reserves the right to require minor changes in location of equipment prior to roughing without any additional cost to the OWNER.

- H. Meters shall be installed in easily accessible locations and orientated for ease of reading and maintenance, and where shown, for balancing flow. Wherever possible, meters shall be inserted in such a way to comply with the manufacturer's recommendations. Meters, shut-off and balancing valves shall be properly supported. In-line meters shall be installed to ensure full-line flow and not less than the manufacturer's recommended head at all times.

3.2 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

- A. **Wiring Installation:** All wires shall be in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing-out panel to components on the fixed structure, and (4) wiring to panel-mounted components. Wiring from components on a swing-out panel to other components on fixed panels shall be tied into bundles with nylon wire ties, and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.
- B. Wiring to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts.
- C. Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.
- D. **Wire Marking:** Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be permanently marked heat-shrink plastic.

3.3 INSTRUMENT CABLE TESTS

- A. **General:** The following tests shall be performed on each instrumentation and control system cable. All tests shall be end-to-end tests of installed cables with the ends supported in free air, not adjacent to any grounded object. All test data shall be recorded on forms which are available from the CONSTRUCTION MANAGER. Complete records of all tests shall be made and delivered to the CONSTRUCTION MANAGER. Each form shall be signed by the CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's Representative who witnessed the testing.
- B. Continuity tests shall be performed by measuring wire/shield loop resistance of each signal cable as the wires, taken one at a time, are shorted to the channel shield. No loop resistance measurement shall vary by more than plus or minus 2 ohms from the calculated average loop resistance value.
- C. Insulation resistance tests shall be performed by using a 500 volt megohmmeter to measure the insulation resistance between each channel wire, between each channel wire and the channel shield, between individual channel shields in a multichannel cable, between each individual channel shield and the overall cable shield in a multi-channel cable, between each wire and ground, and between each shield and ground. Values of resistance less than 1 megohms shall be unacceptable.

3.4 INSTALLATION, CALIBRATION, TESTING, PRECOMMISSIONING, STARTUP AND INSTRUCTION

A. **Installation and Connection:** The CONTRACTOR shall install and connect all field-mounted components and assemblies under the following criteria:

1. Process sensing lines and air signal tubing shall be installed to the installation of conduit indicated under Section 16050. Individual tubes shall be run parallel and near the surfaces from which they are supported. Supports shall be used at intervals not longer than 3 feet of tubing.
2. Bends shall be formed with the proper tool and to uniform radii and shall be made without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square-cut and cleaned before insertion into fittings. Bulkhead fittings shall be provided at all panels requiring pipe or tubing entries.
3. All flexible cables and all capillary tubing shall be provided in flexible conduits. Lengths shall be sufficient to withdraw the cables and tubing for periodic maintenance.
4. All power and all signal wires shall be terminated with spade type lugs.
5. All connectors shall be, as a minimum, water tight.
6. After all installation and connections have been completed, a technical field representative of the CONTRACTOR shall check the WORK for polarity of electric power and signal connections, leaks at all process connections, and conformance with requirements. The technical field representative shall certify in writing to the CONTRACTOR that each loop and system meets requirements.
7. All wire and all cable shall be connected from terminal to terminal without splices, arranged in a neat manner and securely supported in cable groups. All wiring shall be protected from sharp edges and corners.

B. **Calibration:** All analog instrumentation and all control system equipment shall be calibrated and tested after installation to verify that requirements are satisfied. The CONTRACTOR shall provide all necessary labor, tools, and equipment to calibrate and test each instrument in accordance with the manufacturer's instructions. Each instrument shall be calibrated at a minimum of three points using test equipment to simulate inputs and read outputs. All test equipment and all instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall have an accuracy better than the required accuracy of the instrument being calibrated. Test equipment shall have accuracies traceable to the NIST as applicable. All analog instruments shall be calibrated and tested in place without removal. Test data, applicable accuracy requirements, all instrument manufacturer published performance specifications and all permissible tolerances at each point of calibration shall be entered on test forms available from the CONSTRUCTION MANAGER. These test forms shall verify compliance with all. A report shall be delivered to the CONSTRUCTION MANAGER for each instrument, certifying that the instrument

has been calibrated in the presence of the CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's designated representative and meets contract and system requirements.

- C. **Analog Loop Tests:** The CONTRACTOR shall be responsible for loop checking and testing all instrumentation loops with this project. The CONTRACTOR shall coordinate all loop check functions with the CSP to ensure that a single total loop check is conducted. The intent of the loop checks is to confirm and document each loop's component specification conformance up to and including all field-situated CSP devices. The CSP will have all control room personnel present to witness and confirm loop check results at the CRT level. The CONTRACTOR shall provide all necessary labor, tools, and equipment to field test, inspect and adjust each instrument to its indicated performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or any published manufacturer performance specification for functional and operational parameters, whether or not indicated in the Contract Documents, shall be repaired or replaced, at the discretion of the CONSTRUCTION MANAGER at no additional cost to the OWNER.
1. At least 15 days before installation testing begins, the CONTRACTOR shall submit to the CONSTRUCTION MANAGER a detailed description, in duplicate, of the installation tests to be conducted to demonstrate correct installation of the instrumentation and control system and the anticipated dates the testing will occur.
 2. Controllers and electronic function modules, shall be tested and exercised by the CONTRACTOR to demonstrate correct operation, first individually and then collectively as functional analog networks. Each hardwired analog control network shall be tested to verify proper performance within indicated accuracy tolerances. Accuracy tolerances for each analog network are defined as the root-mean-square-summation of individual component accuracy tolerances. Individual component accuracy tolerances shall be as indicated by contract requirements, or by published manufacturer accuracy specifications, whenever contract accuracy tolerances are not indicated.
 3. Each analog network shall be tested by applying simulated inputs to the first element(s). Simulated sensor inputs corresponding to 10 percent, 50 percent, and 90 percent of span shall be applied, and the resulting outputs read to verify compliance to network accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation of discrete devices. Temporary settings shall be made on controllers, alarms, etc., during analog loop tests. All analog loop test data shall be recorded on test forms, which include calculated root-mean-square-summation system accuracy tolerance requirements for each output.
 4. When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms signed by the CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's representative as a witness, with test data entered, shall be submitted together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, fully inspected, and fully tested.

D. **General System Pre-commissioning:** The CONTRACTOR shall be responsible for demonstrating the operability of all systems provided under this specification. The CSP will assist and coordinate the operability assessment with the CONTRACTOR. Pre-commissioning shall commence after acceptance of all wire, all calibrating and loop tests, and all inspections have been conducted. Pre-commissioning shall demonstrate proper operation of all systems with process equipment operating over full operating ranges under actual operating conditions.

1. The CONTRACTOR shall develop and submit to the CONSTRUCTION MANAGER for approval a Pre-Commissioning Plan which describes detailed test procedures, checklists, blank forms and data to be recorded, test equipment to be used and calculated tolerance limits.
2. System pre-commissioning activities shall include means to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments, as required, to eliminate excessive oscillatory amplitudes and decay rates.
3. All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset or rate setting(s) as required to achieve a proper response. Measured final control element variable position/speed setpoint settings shall be compared to measured final control element position/speed values at 10 percent, 50 percent and 90 percent of span and the results checked against indicated accuracy tolerances. Accuracy tolerances are defined as the root-mean-square summation of individual component accuracy tolerances.

Individual component accuracy tolerances shall be as indicated in the Contract Documents or as specified by published manufacturer accuracy specifications whenever not indicated.

4. The CONTRACTOR shall submit an instrumentation and control system pre-commissioning completion report which shall state that all Contract requirements have been met and which shall include a listing of all instrumentation and all control system maintenance and repair activities conducted during the pre-commissioning testing. The CONSTRUCTION MANAGER must accept the instrumentation and control system pre-commissioning testing before the seven day operational testing

may begin. Final acceptance of the control system shall coincide with final acceptance of the WORK.

- E. **7-Day Operational Testing:** The CONTRACTOR shall furnish his own personnel, electrical personnel, and any instrument manufacturers' representatives as required during the testing period to produce a fully operational system.
- F. **Instruction:** The CONTRACTOR shall train the OWNER'S maintenance personnel in the maintenance, calibration and repair of all instruments provided under this contract.
 - 1. The training shall be scheduled a minimum of 3 weeks in advance of the first session. The training shall be performed concurrent with the pre-commissioning in subparagraph D.
 - 2. The training shall be performed by qualified representatives of the instrument manufacturers and shall be specific to each instrument model provided. Instructors shall have at least 2 years of training experience.
 - 3. Each training class shall be a minimum of 8 hours in duration and shall cover Operational Theory, Maintenance, Trouble Shooting/Repair, and Calibration of the instrument.
 - 4. Proposed training material, including resumes for the proposed instructors and a detailed outline of each lesson shall be submitted to the CONSTRUCTION MANAGER at least 30 days in advance of when the lesson is to be given. The CONSTRUCTION MANAGER shall review the submitted data for suitability and provide comments which shall be incorporated into the course.
 - 5. Within 10 days after the completion of each lesson the CONTRACTOR shall present to the CONSTRUCTION MANAGER the following:
 - a. A list of all OWNER personnel that attended the lesson.
 - b. An evaluation of OWNER personnel knowledge through written testing or equivalent.
 - c. A copy of text utilized during the lesson with all notes, diagrams, and comments.

3.5 PROCESS CONTROL STRATEGIES

- A. The control strategies shown in Appendix A1 complement the Process and Instrumentation Diagrams (P&IDs). All materials and components shall be furnished, whether explicitly indicated or not, to effect the functional requirements defined on the P&IDs and in the process control strategy descriptions. The CONTRACTOR shall utilize the control strategies as a resource in generating control narratives to be included in the analog hardware submittal.
- B. Common functions that are generally applicable to all strategies or to similar strategies are described under the heading "General Functions". These functions are not repeated in the descriptions for each strategy.

3.6 INSTRUMENT TAGGING LIST

- A. The contractor shall provide a final master Instrument Tagging List based on field installation.

3.7 EQUIPMENT TAGGING LIST

- A. The contractor shall provide a final master Equipment Tagging List based on field installation.

3.8 SAMPLE LOOPS

- A. **General:** Sample loops are presented at the end of this Section in Appendix B to show the formatting and layout of the loops per City's current standards so that the CONTRACTOR can comply with the requirements of this specification.

** END OF SECTION **

APPENDIX A1 - CONTROL STRATEGIES GENERAL

SECTION 13300 - INSTRUMENTATION AND CONTROL

LEGEND

PCM - Process Control Module (Transmits process data to and from the field and provides plant automation)

DCS - Distributed Control System (Plant Computer Control System)

UPS - Uninterruptable Power System (Provides battery back-up power to the PCM)

DH – Data Highway (Plant process network where PCM, workstation, and historian communications take place)

DIN - District Information Network (Fiber Optic Transmission to COMC)

LCP - Local Control Panels

PID - Proportional-Integral-Derivative

PLC - Programmable Logic Controller

GENERAL CONTROL AND MONITORING

These control strategies are not intended to be all-inclusive operational procedures for the operation of the complete facility. In general, control and monitoring functionality is as follows:

1. Alarm monitoring and generation, process sequencing, automatic control of auxiliary systems and equipment interlocking control strategies are resident within the DCS.
2. Fault tolerant PCM(s) communicate with the DH and contain enhanced DCS automatic control algorithms for process sequencing control based on level, pressure, flow, or other conditions.
3. The DCS workstations shall serve as the operation staff's "window" into the process, enabling operations to locally monitor, interrogate, and manipulate plant processes.
4. The DCS shall provide reporting, historian, diagnostic, client access and other file server functions.
5. The DCS provides information to the District Information Network (DIN) via the communication link between DCS and DIN
6. All alarms shall be fail safe and activate upon loss of power.

COMMON DCS/PLC FUNCTIONS

Common functions and terms for basic monitoring and control operations are provided as a standard of implementation for the control system. These terms and functions address items that are typical for process control loops and most operator initiated actions. These functions are not necessarily repeated in each individual control strategy. Unless otherwise stated they are considered a part of each implemented control strategy.

Provision shall be made to include certain control functions that apply to all analog inputs, virtual variables, analog controllers and discrete control whether or not shown on the P&IDs, even though one or more of the functions may be disabled by the user for a given data base point:

1. **Verification of Digital Outputs:** In Semi-Auto and Auto mode each command will be monitored for the desired results before proceeding to the next step and if the desired results are not achieved in a certain predetermined time an alarm will be generated. The operator will have the ability to override and move to the next stage.
2. **Analog Data Scaling:** This control function shall scale all analog inputs to a common span and shall normalize the digital representation of each analog input to a percent of the operating span. The processed value shall be expressed as a binary number that specifies the analog input's position on a straight line lying between zero and full scale as defined for a given input by the zero span values in the data base.
3. **Amplitude Limit Check:** This control function shall perform dual level, high/low amplitude limit checking and shall identify a limit violation every time a measured or virtual variable goes out-of-limits and returns back into limits. The control function shall determine the time at which each limit excursion occurred. A dead-band shall be provided on each limit and shall be expressed as a percentage of span or in engineering units.
4. **Engineering Unit Conversion:** This control function shall convert scaled analog data to engineering units by means of the following equation:

$$Y = (H - L) (D/DH) + L$$

where:

Y = value in engineering units

H = high value of span, expressed in engineering units

L = low value of span, expressed in engineering units

D = digitized scale input value in counts

DH = full scale digitized value in counts

5. **Discrete Event Monitor:** This control function shall monitor an alarm (where appropriate) all discrete status changes.
6. **Manual Control:** It shall be possible for the operator or plant engineer to interrupt any sequence, loop or automatic operation and operate the same manually from remote.

The following terms are used in the descriptions of DCS/PLC functions:

1. **Operator Settings (Set points):** Operator set or entered values that are adjustable or set from operator displays. Examples of operator set or entered values are controller set points, batch set points, timers, counters, mode selection, etc. Specific values that are required to be operator settable are noted (bracketed []) in the process control strategy descriptions. Unless otherwise stated to be tunable or fixed, a set point value is operator settable.
2. **Tunable Values:** Tunable values are set points that are adjustable at password protected engineer level displays without requiring any PLC or DCS software reconfiguration. Examples of tunable values are tunable time settings, tunable alarm set points, PID tuning constants, etc. These values are not adjustable from operator level displays. Tunable values are also identified and their preliminary values are shown in brackets [xxx].
3. **Fixed Values:** Fixed values are constants that are contained within the PLC or DCS control logic normally inaccessible by the DCS system. Modification of fixed values requires a modification to the control logic via the PLC programming, configuration and diagnostics software package.
4. **Displayed Values:** The term “displayed” means that the value, or information referred to, is displayed in an easily read and understood format on the DCS workstation. Values are identified by their device tag reference and associated equipment number. For analog variables the value is tagged and its associated engineering units are displayed.
5. **Hardware Interlocks:** Hardware interlocks refer to interlocks directly wired within the electrical control circuits of equipment that, when activated, shall cause the equipment to shutdown or otherwise prevent operation of the equipment. Hardware interlocks do not necessarily pass through or depend on the PLC or DCS to be operable.

Hardware interlocks may also be derived by local control panels or switches wired directly to the PLC or DCS to provide direct hardwired alarm status to the PLC or DCS for processing.
6. **Software Interlocks:** Software interlocks refer to interlocks that are generated by the PLC or DCS logic or otherwise pass through the PLC or DCS. Software interlocks are not operable when the PLC is not operable or if for some reason equipment is operated while by-passing the PLC logic.
7. **Hardware Generated Alarms:** Hardware generated alarms are alarms that are generated external to the PLC by equipment such as local control panels, analytical devices and process switches.
 - a. Direct wired alarms that do not depend on the PLC or DCS to be operable. An example would be a High H₂S level signal from the H₂S monitor and wired directly to an alarm light or horn.
 - b. Direct PLC wired alarms such as a High-High pressure switch that interfaces directly with the PLC.

8. **Software Generated Alarms:** Alarms that are processed or generated by PLC or DCS logic are referred as software generated. Software generated alarms are displayed on the DCS workstation alarm screens and are available for archiving.
9. **Local Automatic Control Mode:** Local automatic control refers to control logic performed in a local control panel independent of the PLC or DCS. An example is a standalone blower package that, when in the local automatic control mode, automatically controls the blower to maintained air pressure within a fixed dead band.
10. **Local Manual Control Mode:** Local manual control refers to the mode where operators control equipment from the equipment location. Examples are hoist and trolley that may be stopped or started from the hoist/trolley's local control panel (LCP), or a gate that may be opened or closed from the gate operator.
11. **DCS Automatic Control Mode:** In DCS automatic mode equipment is controlled automatically per predetermined control schemes residing in the DCS usually without operator intervention. However, in some cases the operators may be required to initiate certain automatic functions, or enter set points.
12. **DCS Manual Control Mode:** DCS manual control refers to the remote manual control of equipment from the DCS workstation. In this mode, the operators override the DCS automatic control logic but, usually, DCS safety interlock logic remains in effect.
13. **DCS Override Control:** DCS override control refers to the ability to override specific software interlocks and initiate control actions. Software interlocks or permissives that can be overridden are identified within the individual control strategies. Override control is an abnormal control operation and a "SAFETY INTERLOCK OVERRIDE ALARM" shall be initiated for the specific override condition whenever an override command is in effect.

COMMON DCS/PLC SOFTWARE FUNCTIONS

To provide for a standard of implementation, various software control and monitoring functions are defined. The standard functions may not be fully delineated within each control strategy, however, unless otherwise stated the standard function shall be utilized to provide the defined alarm, action, display or control action.

The following provides for common PLC and DCS software functions:

1. All equipment status items monitored by the DCS/PLC and generated within the DCS/PLC control strategies are displayed at the DCS. Unless otherwise specified the following is displayed for each equipment item:
 - a. Equipment READY status
 - b. Equipment RUNNING or ON status
 - c. Equipment OFF status
 - d. Equipment FAILURE alarm
 - e. Equipment FAIL-TO-OPERATE alarm

f. Equipment OUT-OF-SERVICE

2. All analog inputs transmitted to the DCS shall have instrument bad/failure indications or alarms when the input is below 0 percent or above 100 percent.
3. All discrete alarm and failure inputs are alarmed by the DCS application software and displayed at the DCS. Each discrete alarm input shall have an associated alarm delay that prevents nuisance tripping. A discrete alarm shall be generated based on a tunable set point of 10 seconds after the discrete event is initiated.
4. Where alarms are specified in the control strategy descriptions, those alarms are initiated by the DCS control logic based on the applicable analog input signals. User tunable trip points shall be provided for each analog input to establish High- High, High, Low, Low-Low, and Rate-Of-Change events. Each trip point shall be provided with a user tunable dead band for set and reset operations. Individual signal trip points shall be provided with a tunable delay to alarm activation.
5. DCS alarm activation and annunciation shall adhere to a priority hierarchy that is established and maintained at the DCS system. Each alarm shall have an associated priority level defined as:

Level 1 - Life Threatening or Danger Conditions

Level 2 - Critical process alarms that shall create a plant shutdown condition, cause a critical process failure or severely hinder plant operation.

Level 3 - Minor process alarms associated with warning conditions and minor equipment failures.

Level 4 - Informational alarms shall not hinder operation or cause equipment failure.

6. All process related analog inputs are trended at the discretion of the operator.
7. All flow inputs and equipment run times are totalized, recorded and displayed at the DCS. Totalizers are resettable at the engineer level only.
8. **Displays:** DCS system shall have adequate number of displays for each system to enable the operator to effectively monitor and control the system. Displays are grouped functionally for ease of operation. Both analog and discrete functions associated with an item of equipment or a group of equipment shall be provided on the same display. Displays shall show process graphics, alarms, equipment status, system mode of operation, control strategy implementation, etc.
9. Most interlocks, permissives and start sequences are provided at the DCS level. Unless otherwise stated or shown, all discrete outputs shall be provided as follows:
 - a. For equipment START functions, the PLC or DCS shall issue a maintained START command until a RUNNING state is detected or the START command is removed.

- b. When a momentary command is required, the PLC or DCS shall issue the command for a minimum 2 seconds, then remove the signal.
10. For equipment that the DCS/PLC is allowed to control, the DCS/PLC shall provide a FAIL-TO-OPERATE alarm if the equipment fails to comply with a DCS/PLC command signal. The (START, STOP, OPEN, CLOSE) shall have been present for more than a tunable time period. In this event, the command shall be removed subsequent to the expiration of the tunable time period.
11. In the event of a DCS system failure the system shall retain the last command from the DCS system for all equipment that is in service. All interlocks are enabled during a DCS communications or systems failure.
12. All PID control functions (P, PI, and PID) are provided with standard analog controller functions and operator interfaces including, but not limited to, the following:
 - a. AUTO/MANUAL mode selection: In AUTO, the output of controller shall be based on the PID control calculation. In MANUAL, the output of the controller shall be operator adjustable. Transfer between operational modes shall be bumpless.
 - b. LOCAL/REMOTE set point selection: In LOCAL, the set point shall be operator adjustable from the equipment. In REMOTE, the set point shall be adjustable from a REMOTE set point input.
 - c. Set point, process variable, and controller output shall be displayed. Provisions shall be included to prevent reset windup.
 - d. Dead band limits shall be placed on PID control algorithms to avoid hunting and continuous change actions. Dead band limits shall maintain a constant control until the process variable exceeds the dead band boundaries. A dead band value of zero shall disable the dead band.
 - e. Bumpless transition shall be provided when PID is invoked after a transition from manual to PID control or when pump start logic utilizes minimum speed controls for starting applications. The transition from current speed to calculated speed shall be provided as a user tunable set point percentage per second value.
13. When main equipment is tagged OUT-OF-SERVICE, a DCS function, all associated equipment and devices are automatically placed in OUT-OF-SERVICE status and their alarms inhibited until the tagged equipment is tagged IN SERVICE. Associated equipment for each piece of main equipment shall be determined on a case by case basis.
14. **Verification of Result:** Whenever a command is issued, DCS/PLC shall verify that its command is implemented before proceeding to the next step, e.g., a valve open command is issued, the DCS/PLC software shall verify that the valve open limit switch is activated after a preset time, before proceeding to the next step in the program. If no verification is received an alarm will be generated and operator intervention will be necessary to resume the automatic operation.

**APPENDIX A2
PROCESS AND CONTROL STRATEGIES
AND DESIGN PHILOSOPHY**

SECTION 13300 - INSTRUMENTATION AND CONTROL

GENERAL DESCRIPTION

There are five existing primary sludge pumps driven by compressed air. The associated suction header and pump lateral suction motorized valves can be arranged so that any of the five sedimentation basins can feed any of the five existing primary sludge pumps, though typically each pump is just dedicated to the adjacent sedimentation basin.

This project will demolish all five air-driven primary sludge pumps and replace only two pumps in the location of pumps #2 and #3 with new electric-driven pumps. The two new electric-driven pumps will service all five sedimentation basins. The new pumps will operate on a lead/standby configuration selectable by the Operator in the DCS. The existing motorized suction valving will remain in place.

The DCS programmer should be able to salvage some of the existing programming and modify it to suit the new configuration. Some of the significant differences include the following:

- There is existing logic that utilizes a stroke rate feedback to calculate flowrate; that logic will no longer be utilized and shall be deleted. The new pumps are constant speed and will operate on a preprogrammed duration.
- The new system will include an in-line Grinder feeding to the suction of the Primary Sludge Pump to break up and grind primary sludge lumps that may clog the pump. Before the Primary Sludge Pump is called to start, the Grinder shall be called to start first.
- See DCS I/O mapping on drawing 10E-4, for remapped I/O points.

Sequence of Construction

Step 1: Existing Primary Sludge Pumps #1 and #2 shall be demolished first. Once these two pumps are demolished, the new Primary Sludge Pump and Grinder No.1 system shall be installed and commissioned.

Step 2: Existing Primary Sludge Pumps #3 and #4 shall be demolished second. Once these two pumps are demolished, the new Primary Sludge Pump and Grinder No.2 system shall be installed and commissioned.

Step 3: Existing Primary Sludge Pumps #5 shall be demolished last.

The DCS programmer shall coordinate interim DCS programming to accommodate testing and commissioning of the new Primary Sludge Pump and Grinder systems.

The Contractor shall assure that at all times, Sedimentation Basin #1 through #5 piping and motorized valves can feed an operable pump system (either old or new pumping system). In addition, two pumps shall be available at all times (any combination of old or new pumping system).

Process and Control Strategies

The CONTRACTOR shall meet the functionality, intent, and requirements provided in this specific control strategy, other related controls strategies, equipment specific specification, control diagrams, P&ID's, and all other related Contract Documents. Not all information is explicitly provided in each of these documents, but all of the Contract Documents as a whole constitute the requirements to be provided by the CONTRACTOR. It is the intent of the Contract Documents to show information once, and not to repeat that information again and again throughout all the other related documents. The CONTRACTOR is responsible for a complete and functional system. The CONTRACTOR is responsible for providing their subs with all the required information.

GRINDER AND PRIMARY SLUDGE PUMP SYSTEM (TYP OF 2)

1.1 Grinder and Primary Sludge Pump System - Overview of Strategy

The Sedimentation Basin's #1 thru #5 corresponding sumps requires having their sumps drawn down periodically. Existing motorized valving can be configured to draw down each of the Sedimentation Basins one at a time. The Operator shall select the Lead Primary Sludge Pump and Grinder system. The system shall normally be rotated through in ascending order, starting with Primary Sedimentation Basin #1 up through and ending at Sedimentation Basin #5. The sequence shall be on preset timers, and initiate and rotate through automatically.

To start the automatic sequence of operation, the DCS shall open the corresponding motorized valves to draw from Sedimentation Basin #1 and feed the Lead Primary Sludge Pump and Grinder system. Once the suction valves are open, the Lead Grinder shall be called to start. Once the DCS receives the Grinder Running signal, the DCS shall call to start the Lead Primary Sludge Pump. The Primary Sludge Pump and Grinder system shall run for the duration programmed in the DCS (Operatable settable 0 to 30 minutes; set to 20 minutes for initial commissioning). As soon as the pre-programmed duration has timed out, the next Sedimentation Basin #2 corresponding motorized valves shall open. Once the valve is confirmed open by the DCS, the previous Sedimentation Basin #1 corresponding motorized valves shall close. The sequence shall repeat in a similar manner until the Sedimentation Basin # 5 has completed its draw down duration. Once the sequence is complete, the Lead Primary Sludge Pump shall be turned off, once the pump is confirmed off, then the grinder shall be turned off, and then all the valves closed. Another timer shall start to delay the system from starting all over again from the beginning, (Operatable settable 0 to 90 minutes; set to 45 minutes for initial commissioning).

1.2 Local Control

Primary Sludge Pump: All local control for the pumps is at the local panel when in Hand. The pump can be locally started, stopped, and reset any local alarms manually. There is also a LOS at the pump. See drawing 10E-6 control diagram for local permissives.

Grinder: All local control for the grinders is at the local panel when in Hand. The grinder can be locally started, stopped, and reset any local alarms manually. There is also a LOS at the pump. See vender provided wiring diagram for details. The grinder has all the local forward and reversing logic to attempt to dislodge any jams automatically. After a few cycles, if the jam does not clear, an alarm will trigger and the grinder will turn off.

1.3 DCS Manual Control

Prior to operating the Primary Sludge and Grinder system in DCS Manual Control, the Operator must open the appropriate suction valves.

- Primary Sludge Pump: Operators may manually run the pumps from the DCS workstation when the pumps are available for remote control.
- Grinder: Operators may manually run the grinders from the DCS workstation when the grinders are available for remote control.

1.4 DCS Automatic Control See section 1.1 for description.

1.5 Failure Modes

- Primary Sludge Pump: Pumps hardwired alarm point to the DCS will shut down the pump and associated grinder and then the next standby pump and grinder system shall automatically take over the duty.
- Grinder: Grinders hardwired alarm point to the DCS will shut down the grinder and associated pump and then the next standby pump and grinder system shall automatically take over the duty.

1.6 Software Interlocks

See sections above.

1.7 Restart after Power Failure Strategy

The existing logic (if any) shall be modified as required to assure that there is adequate power before restarting a pump or grinder.

1.8 Phased Shutdown on Power Failure N/A.

1.9 Out of Service

An Operator shall be able to place any of the equipment out of service via the DCS workstation.

1.10 Alarms

Below are the hardwired alarms.

TAG	DESCRIPTION	PRIORITY
YA-711	Primary Sludge Pump No.1 Alarm	2
YA-712	Primary Sludge Pump No.2 Alarm	2
YA-711A	Grinder No.1 Alarm	2
YA-712A	Grinder No.2 Alarm	2

Alarm Priority Definitions:

Level 1 - Life Threatening or Danger Conditions

Level 2 - Critical process alarms that shall create a plant shutdown condition, cause a critical process failure or severely hinder plant operation.

Level 3 - Minor process alarms associated with warning conditions and minor equipment failures.

Level 4 - Informational alarms shall not hinder operation or cause equipment failure.

Analog points shall have two alarm priorities, one for high alarms and the second for low alarms.

1.11 Communications Interfaces N/A

**APPENDIX B
SAMPLE LOOP DRAWINGS**

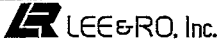
SECTION 13300 - INSTRUMENTATION AND CONTROL

LOOP NO: 05F7331

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	FCV	7331		BLOWER 1 CONTROL VALVE	SET POINT	CONTROL VALVE	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	FIC	7331		BLOWER 1 CONTROL VALVE	SET POINT	DCS	05PCM03C	WESTINGHOUSE	WDPF11	13300	ORION	43	
P	05	ZI	7331		BLOWER 1 CONTROL VALVE	POSITION	DCS	05PCM03C	WESTINGHOUSE	WDPF11	13300	ORION	43	
P	05	ZL	7331		BLOWER 1 CONTROL VALVE	REMOTE	DCS	05PCM03C	WESTINGHOUSE	WDPF11	13300	ORION	43	
P	05	ZT	7331		BLOWER 1 CONTROL VALVE	POSITION	CONTROL VALVE	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	A	BLOWER 1 CONTROL VALVE	LOCAL/REMOTE	3-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	B	BLOWER 1 CONTROL VALVE	OPEN/CLOSE	2-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	C	BLOWER 1 CONTROL VALVE	STOP	3-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	D	BLOWER 1 CONTROL VALVE	OPEN/CLOSE	2-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZSC	7331		BLOWER 1 CONTROL VALVE	VALVE CLOSED	LIMIT SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZSQ	7331		BLOWER 1 CONTROL VALVE	VALVE OPENED	LIMIT SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZLC	7331		BLOWER 1 CONTROL VALVE	VALVE CLOSED	INDICATOR	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZLO	7331		BLOWER 1 CONTROL VALVE	VALVE OPENED	INDICATOR	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	FCV	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	FIC	7331		BLOWER 1 CONTROL VALVE	N/A	AO	4-20 MA	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZI	7331		BLOWER 1 CONTROL VALVE	N/A	AI	4-20 MA	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZL	7331		BLOWER 1 CONTROL VALVE	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZT	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	A	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	B	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	C	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	D	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZSC	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZSQ	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZLC	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZLO	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003

REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL	
P & ID:	REV	DATE	DESCRIPTION	BY	CHKD	ENGR	MGR
ELECTRICAL/CONDUIT DWG: 5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
FLOW & PIPING PLAN: 5-M-4 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
ELECTRICAL SINGLE LINE: 5-E-14 & 5-E-17	C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS
ELECTRICAL POWER PLAN: 5-E-101, 130							
CONTROL WIRING: 5-F-23							
EIM CONTROLS: TEC-3102-0000							



POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

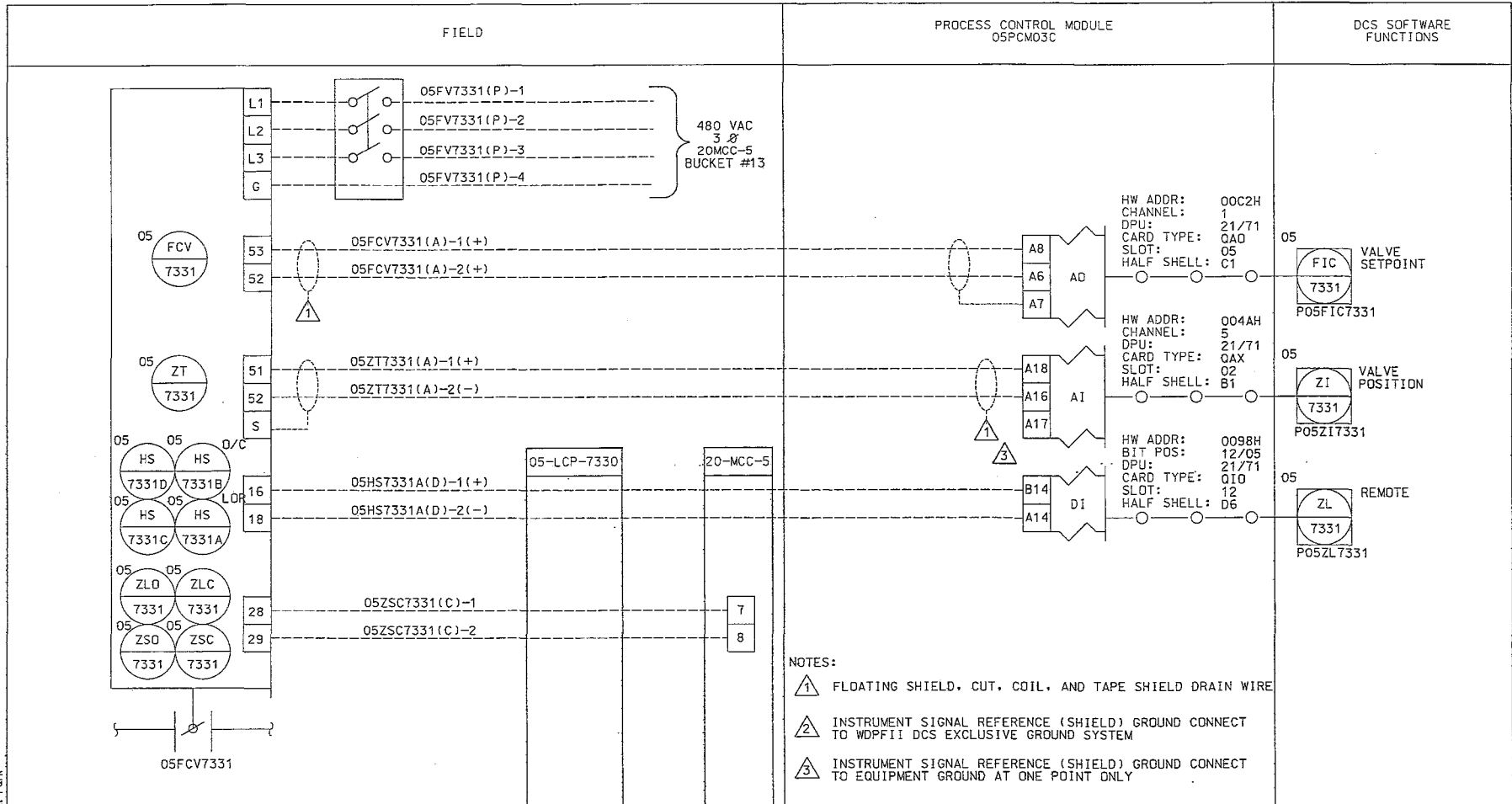
INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER 1
CONTROL VALVE

LOOP NO. 05F7331	DWG NO. LD-PLWTP05F7331	CIP NO. 46-943.0	FILE 05F7331.001
		SHEET 1 OF 3	REV C

PROJECTS\823-Air Blower Facility\Design\elect\05F7331.rvt
11/14/11 PM
11/14/2011

SAMPLE LOOPS

San Diego WWS - San Diego Upgrade Project
Blowing Station SW 15 - Storage Pump & Grinder Installation
Attachment E - Technicals (Rev. July 2015)



- NOTES:
- ① FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE
 - ② INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
 - ③ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY

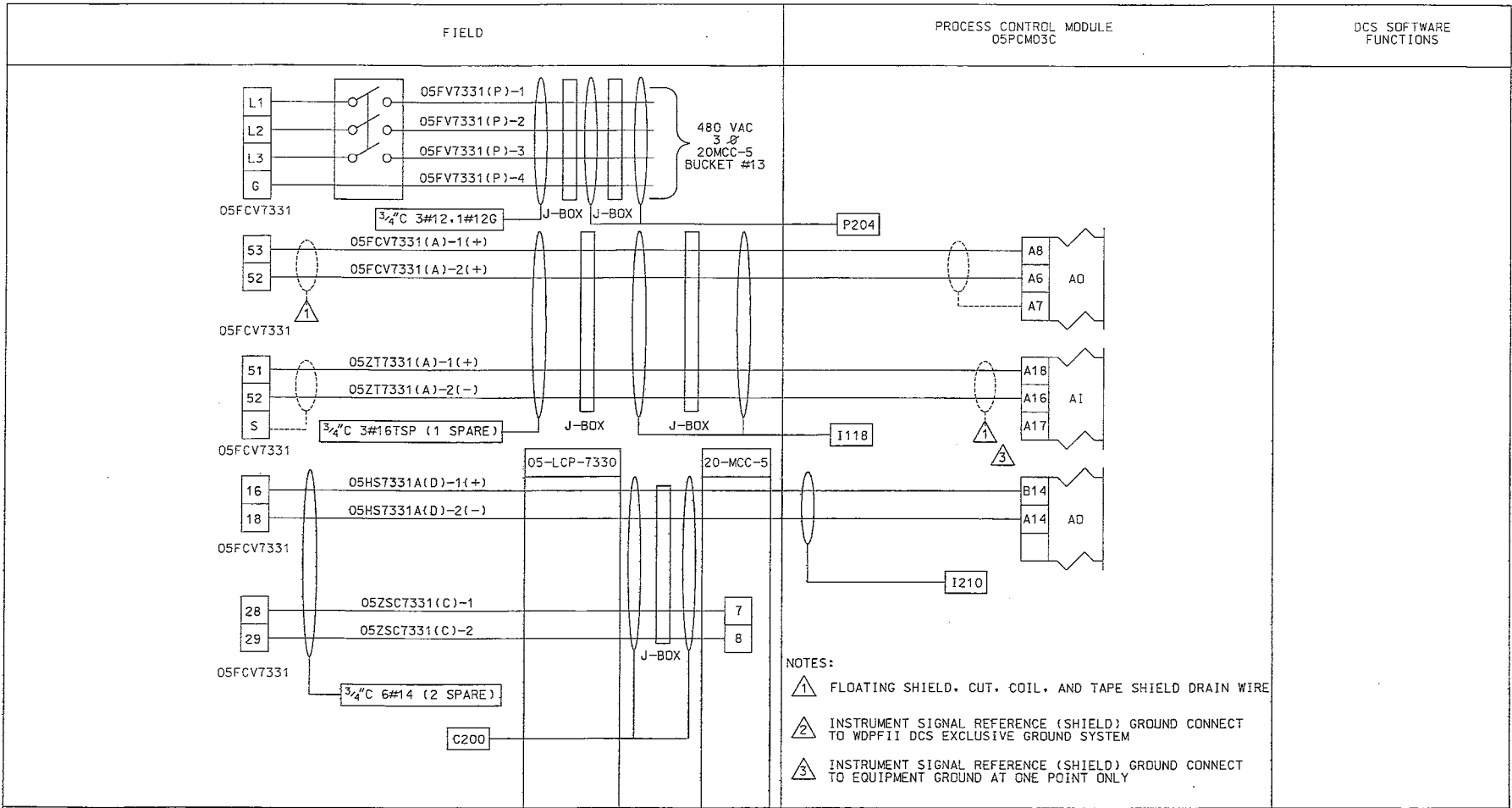
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 PREVIOUS: 023-Air Blower Facility Design\elec\05F7331.ref

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P & ID:	5-I-24	REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR		
ELECTRICAL/CONDUIT DWG:	5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS		
FLOW & PIPING PLAN:	5-M-4 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS		
ELECTRICAL SINGLE LINE:	5-E-14 & 5-E-17	C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS		
ELECTRICAL POWER PLAN:	5-E-101, 130									
CONTROL WIRING:	5-F-23									
EIM CONTROLS:	TEC-3102-0000									
						LOOP NO.	DWG NO.		SHEET	REV
						05F7331	LD-PLWTP05F7331		2 OF 3	C



POINT LOMA GRIT AERATION SYSTEMS PROJECT
 METROPOLITAN WASTEWATER DEPARTMENT
 CITY OF SAN DIEGO, CALIFORNIA
 CIP NO. 46-943.0
 FILE 05F7331.002
 SHEET 2 OF 3
 REV C

SAMPLE LOOPS
 Equipment & Control Upgrade Project
 Attachment E - Technicals (Rev. July 2015)



- NOTES:
- ① FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE
 - ② INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
 - ③ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY

REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL	
P & ID:	REV	DATE	DESCRIPTION	BY	CKD	ENGR	MSR
5-I-24	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
5-E-500	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
5-M-4 & 5-M-100	C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS
5-E-14 & 5-E-17							
5-E-101, 130							
5-F-23							
TEC-3102-0000							

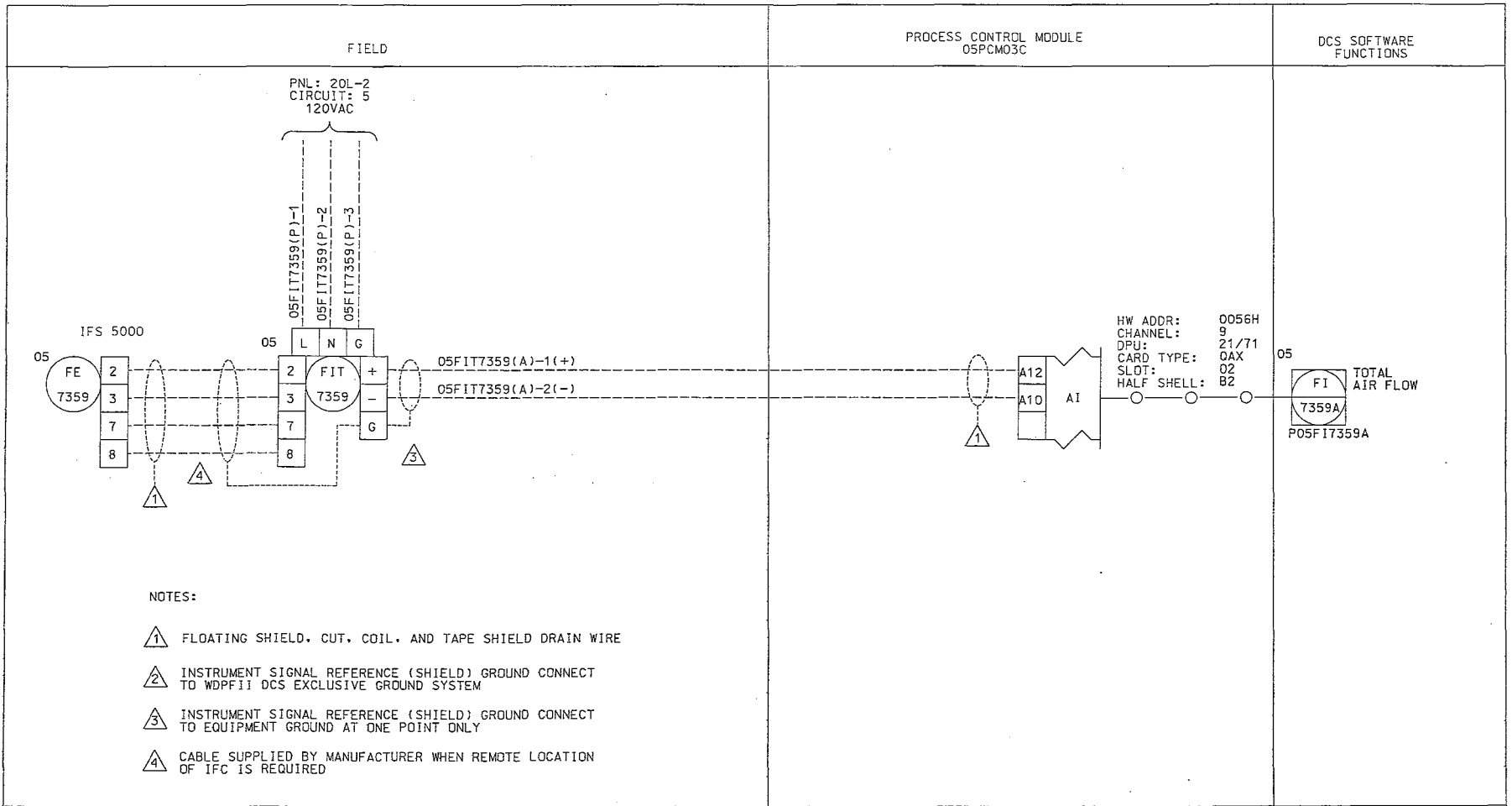
POINT LOMA GRIT AERATION SYSTEMS PROJECT		CIP NO.
METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		46-943.0
INTERCONNECTION DIAGRAM GRIT AERATION BLOWER 1 CONTROL VALVE		FILE
		05F7331.003
LOOP NO.	DWG NO.	SHEET
05F7331	LD-PLWTP05F7331	3 OF 3
		REV
		C



M:\P\03\823\PREVIOUS PROJECTS\03-Air Blower Facility\Design\elect\05f7331.eef
 1:14:24 PM Daniel Park
 6/25/2009

SAMPLE LOOPS

Electrical Work Scope Upgrade Project Installation
 Attachment E - Technicals (Rev. July 2015)



NOTES:

- ⚠ FLOATING SHIELD. CUT. COIL. AND TAPE SHIELD DRAIN WIRE
- ⚠ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
- ⚠ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY
- ⚠ CABLE SUPPLIED BY MANUFACTURER WHEN REMOTE LOCATION OF IFC IS REQUIRED

REFERENCE DRAWINGS

DESTROY ALL PRINTS BEARING EARLIER DATE

APPROVAL

P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-101
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL EQUIPMENT:	5-E-17
ELECTRICAL PANEL SCHEDULE:	5-E-504
ELECTRICAL CONDUIT PLAN & SCHEDULE:	5-E-101 & 5-E-500

REV	DATE	DESCRIPTION	BY	CHK	ENGR	MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

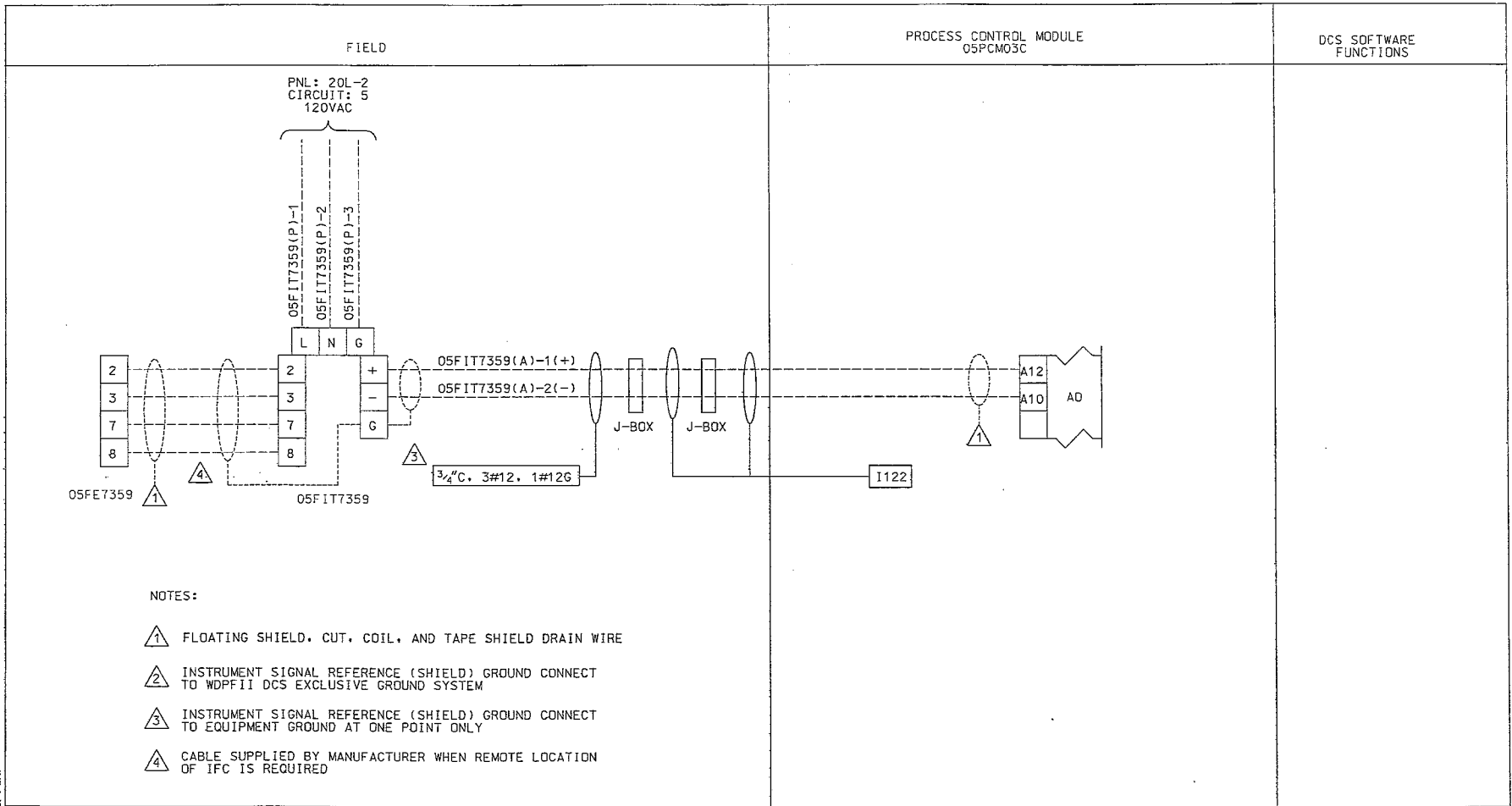
<p>POINT LOMA GRIT AERATION SYSTEMS PROJECT METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA</p>		CIP NO.	
		46-943.0	
<p>INSTRUMENT LOOP DIAGRAM GRIT AERATION BLOWER FLOW METER</p>		FILE	
		05F7359.002	
LOOP NO.	DWG NO.	SHEET	REV
05F7359	LD-PLWTP05F7359	2 of 3	C



SAMPLE LOOPS

San Diego Station No. 85 - Capacity Upgrade Project
Blowing Saw RP Storage Pump & Grinder Installation
Attachment E - Technicals (Rev. July 2015)

PROJECT: 023-Blower Facility Design\Design\05F7359.ref
 Date: 7/25/2008 11:03 AM
 Daniel Park



NOTES:

- ⚠ FLOATING SHIELD. CUT, COIL, AND TAPE SHIELD DRAIN WIRE
- ⚠ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
- ⚠ INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY
- ⚠ CABLE SUPPLIED BY MANUFACTURER WHEN REMOTE LOCATION OF IFC IS REQUIRED

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Daniel Park
11:16:07 PM
2/25/2009

SAMPLE LOOPS

Pump Station No. 65 - Capacity Upgrade Project
Blowing Station - Stage Pump & Grinder Installation
Attachment E - Technicals (Rev. July 2015)

REFERENCE DRAWINGS

P & ID:	5-1-24
ELECTRICAL/CONDUIT DWG:	5-E-101
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL EQUIPMENT:	5-E-17
ELECTRICAL PANEL SCHEDULE:	5-E-504
ELECTRICAL CONDUIT PLAN & SCHEDULE:	5-E-101 & 5-E-500

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS


APPROVAL

<p>San Diego, California</p>		<p>POINT LOMA GRIT AERATION SYSTEMS PROJECT</p> <p>CIP NO. 46-943.0</p>	
<p>LOOP NO. 05F7359</p>		<p>DWG NO. LD-PLWTP05F7359</p>	
<p>INTERCONNECTION DIAGRAM GRIT AERATION BLOWER FLOW METER</p>		<p>FILE 05F7359.003</p>	
<p>SHEET 3 OF 3</p>		<p>REV C</p>	

LOOP NO: 05P7330

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	PSH	7330		AERATION BLOWER 1	DISCH PRESS	PRESS SWITCH	5-GAB-7330	SDR	14N	13300	ORION		
P	05	PAH	7330		AERATION BLOWER 1	DISCH PRESS	DCS	05PCM03C	WESTINGHOUSE	WDPF11	13400	ORION	43	
P	05	PAH	7330	A	AERATION BLOWER 1	DISCH PRESS	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	13300	ORION	46	

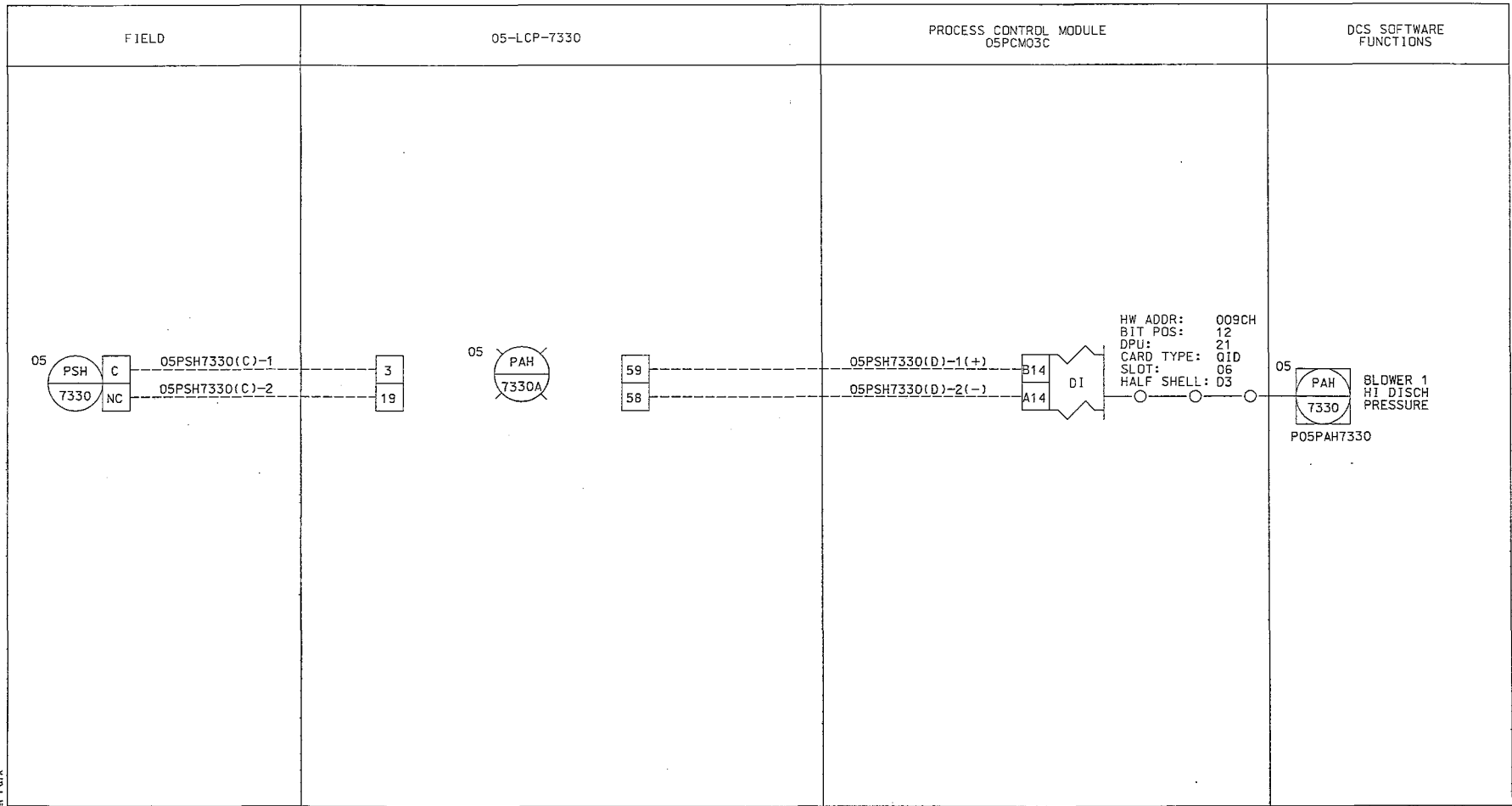
N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	PSH	7330		AERATION BLOWER 1	S20.42	N/A	N/A	0-25	PSI	15 (RISING)	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003
P	05	PAH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003
P	05	PAH	7330	A	AERATION BLOWER 1	N/A	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003

P & ID:		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL		 San Diego, California		
REV	DATE	DESCRIPTION	BY	CHKD	ENGR	MGR			CIP NO.	
ELECTRICAL/CONDUIT DWG: 5-I-24								POINT LOMA GRIT AERATION SYSTEMS PROJECT		46-943.0
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS	METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA			
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS	INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE GRIT AERATION BLOWER 1 DISCH PRESS			
ELECTRICAL SINGLE LINE: 5-E-13, 5-E-17, AND 5-E-15								FILE		05P7330.001
ELECTRICAL POWER PLAN: 5-E-101								LOOP NO.		05P7330
CONTROL WIRING: 5-F-23								DWG NO.		LD-PLWTP05P7330
GARDNER DENVER CONTROLS: VP1024154								SHEET		1 OF 3
								REV		C

SAMPLE LOOPS

Electrical Wiring & Control Installation
Attachment E - Technicals (Rev. July 2015)

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 6/25/2008 1:17:21 PM D:\trial Park



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 Daniel Park
 1/17/26 PM
 6/25/2009

SAMPLE LOOPS

Piping Station No. 65 - Gardner Upgrade Project
 Blowing Station - Storage Tank & Grinder Installation
 Attachment E - Technicals (Rev. July 2015)

REFERENCE DRAWINGS

P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-F-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE

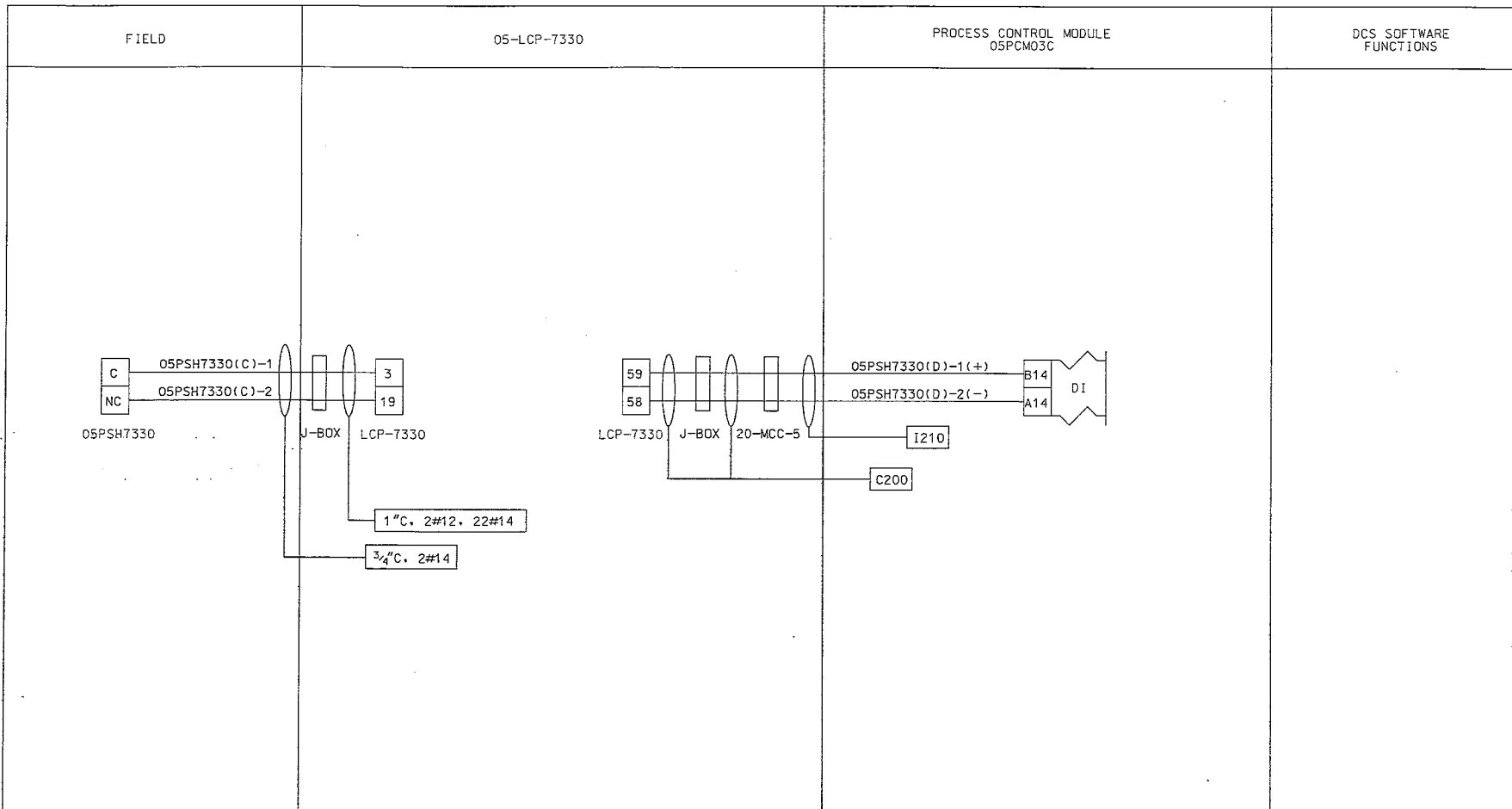
REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR
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B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

APPROVAL

BY	CKD	ENGR	MGR
TP	RS	LB	JS
TP	RS	LB	JS
TP	RS	LB	JS



POINT LOMA GRIT AERATION SYSTEMS PROJECT METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		CIP NO. 46-943.0
INSTRUMENT LOOP DIAGRAM GRIT AERATION BLOWER 1 DISCH PRESS		FILE 05P7330.002
LOOP NO. 05P7330	DWG NO. LD-PLWTP05P7330	SHEET 2 OF 3 REV C



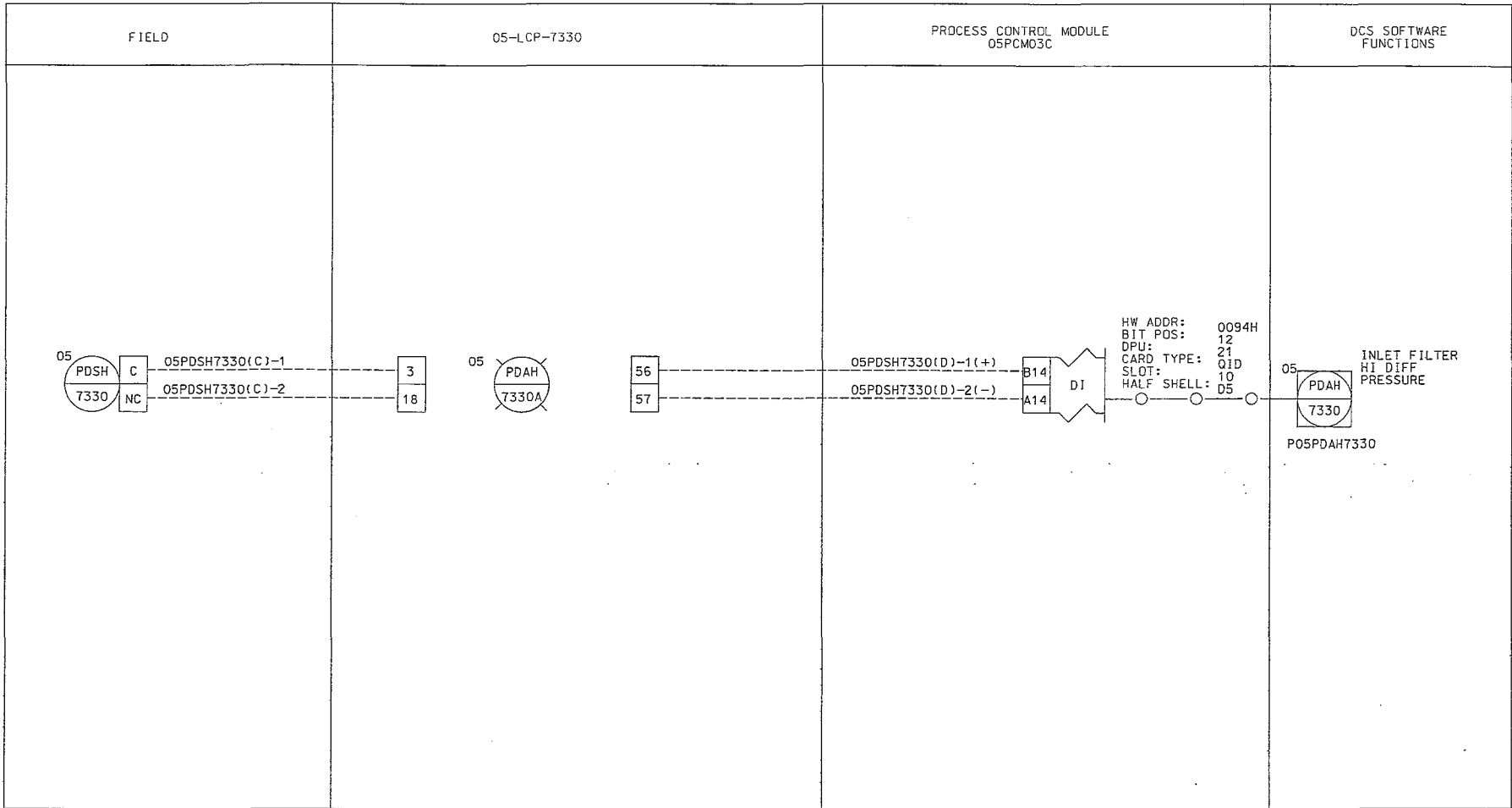
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 05/20/08
 05/20/08

REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL			
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ELECTRICAL/CONDUIT DWG:	5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS	
FLOW & PIPING PLAN:	5-M-14 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS	
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS	
ELECTRICAL POWER PLAN:	5-E-101								
CONTROL WIRING:	5-F-23								
GARDNER BENVER CONTROLS:	VP1024154								

 San Diego, California		POINT LOMA GRIT AERATION SYSTEMS PROJECT METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA	CIP NO. 46-943.0
INTERCONNECTION DIAGRAM GRIT AERATION BLOWER 1 DISCH PRESS		FILE 05P7330.003	
LOOP NO. 05P7330	DWG NO. LD-PLWTP05P7330	SHEET 3 OF 3	REV C

SAMPLE LOOPS

Euno Station No. 65 - Capacity Upgrade Project
 Blowing Station Storage Pump & Grinder Installation
 Attachment E - Technicals (Rev. July 2015)



23 PREVIOUS PROJECTS\823-Air Blower Facility\Design\elect\05pd7330.ref
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REFERENCE DRAWINGS

DESTROY ALL PRINTS BEARING EARLIER DATE

APPROVAL

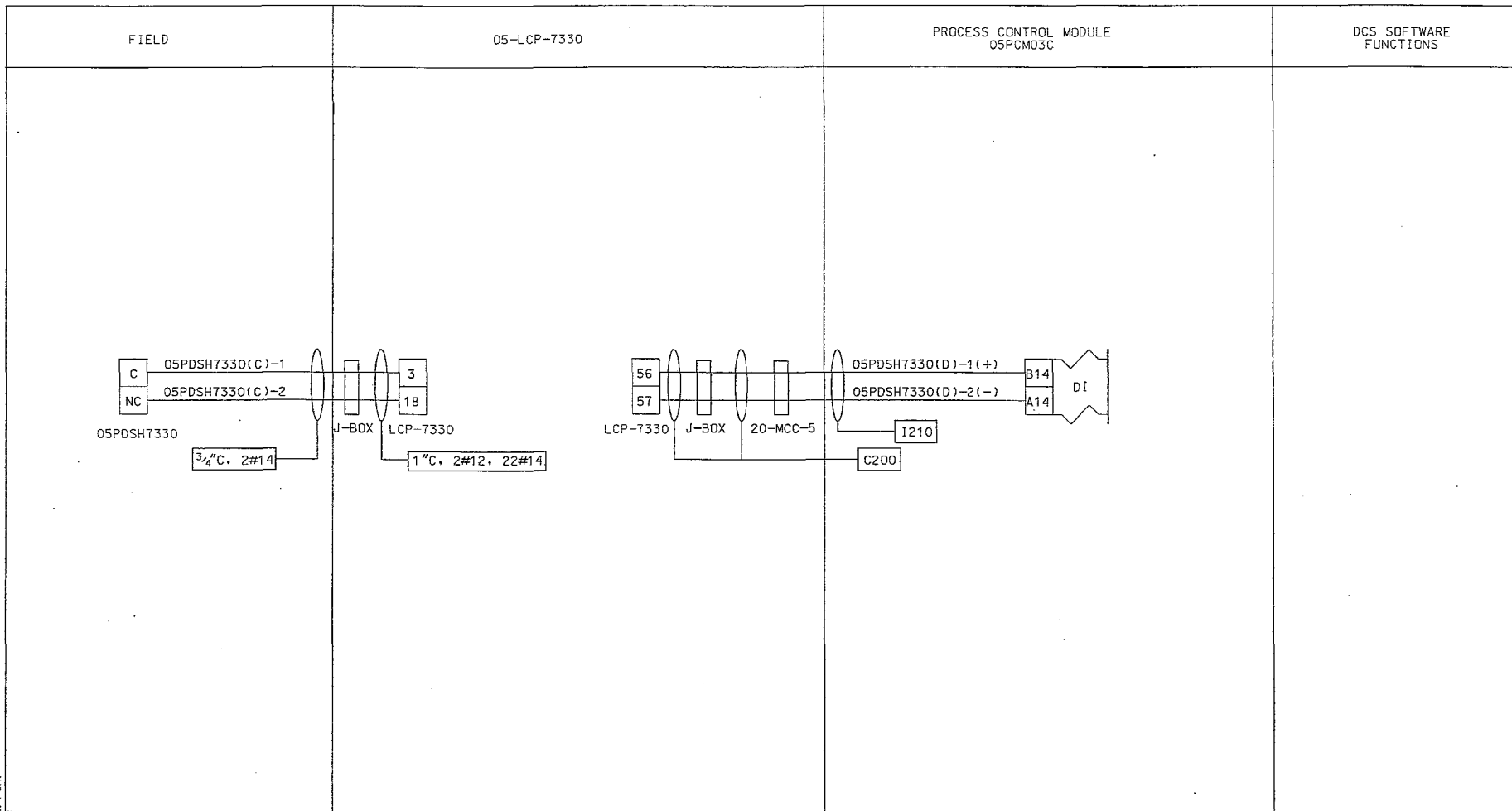
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FLOW & PIPING PLAN:	5-M-14 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS
ELECTRICAL POWER PLAN:	5-E-101							
CONTROL WIRING:	5-E-23							
GARDNER DENVER CONTROLS:	VP1024154							



POINT LOMA GRIT AERATION SYSTEMS PROJECT		CIP NO.	46-943.0
METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		FILE	05PD7330.002
INSTRUMENT LOOP DIAGRAM GRIT AERATION BLOWER 1 FILTER PRESS		SHEET	2 OF 3
LOOP NO.	DWG NO.	REV	C
05PD7330	LD-PLWTP05PD7330		

SAMPLE LOOPS

5-Bldg Station No. 65 - 6888th Upgrade Project
 5-Bldg Station No. 65 - 6888th Upgrade Project Installation
 Attachment E - Technicals (Rev. July 2015)



REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL			
P & ID:	REV	DATE	DESCRIPTION	BY	CHKD	ENGR	MGR		
5-I-24	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS		
ELECTRICAL/CONDUIT DWG: 5-E-500	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS		
FLOW & PIPING PLAN: 5-M-14 & 5-M-100	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS		
ELECTRICAL SINGLE LINE: 5-E-13, 5-E-17, AND 5-E-15									
ELECTRICAL POWER PLAN: 5-E-101									
CONTROL WIRING: 5-F-23									
CARDNER DENVER CONTROLS VP1024154									



POINT LOMA GRIT AERATION SYSTEMS PROJECT		CIP NO.
METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		46-943.0
INTERCONNECTION DIAGRAM GRIT AERATION BLOWER 1 FILTER PRESS		FILE
		05PD7330.003
LOOP NO.	DWG NO.	SHEET
05PD7330	LD-PLWTP05PD7330	3 OF 3
		REV
		C

SAMPLE LOOPS

Public Station No. 15 - Capacity Upgrade Project
 Building Sewer Stage 1 Upgrade Grinder Installation
 Attachment E - Technicals (Rev. July 2015)

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 07/25/2009 1:18:53 PM Daniel Park

LOOP NO: 05T7330

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	TE	7330	A	AERATION BLOWER 1	INLET BEARING	RTD	5-GAB-7330	LAMSON	300RGA1354	11372	ORION	46	
P	05	TE	7330	B	AERATION BLOWER 1	OUTLET BEARING	RTD	5-GAB-7330	LAMSON	300RGA1354	11372	ORION	46	
P	05	TAH	7330		AERATION BLOWER 1	HI TEMP	DCS	05PCMO3C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	TAHH	7330		AERATION BLOWER 1	HI HI TEMP	DCS	05PCMO3C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	TI	7330	A	AERATION BLOWER 1	INLET BEARING	PANEL METER	5-GAB-7330	RED LION	PAXT0000	11372	ORION	46	
P	05	TI	7330	B	AERATION BLOWER 1	OUTLET BEARING	PANEL METER	5-GAB-7330	RED LION	PAXT0000	11372	ORION	46	
P	05	TAHH	7330	A	AERATION BLOWER 1	HI HI INL BEAR	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	11372	ORION	46	
P	05	TAHH	7330	B	AERATION BLOWER 1	HI HI OUT BEAR	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	11372	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	TE	7330	A	AERATION BLOWER 1	S20.13A	N/A	MIL VOLT	400	DEG F	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TE	7330	B	AERATION BLOWER 1	S20.13A	N/A	MIL VOLT	400	DEG F	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TAH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TI	7330	A	AERATION BLOWER 1	N/A	N/A	MIL VOLT	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TI	7330	B	AERATION BLOWER 1	N/A	N/A	MIL VOLT	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330	A	AERATION BLOWER 1	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330	B	AERATION BLOWER 1	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PLWTP05T7330	5-1-24	P05T7330.002	P05T7330.003

REFERENCE DRAWINGS

DESTROY ALL PRINTS BEARING EARLIER DATE

APPROVAL

P & ID:	REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR
ELECTRICAL/CONDUIT DWG: 5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
FLOW & PIPING PLAN: 5-M-14 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
ELECTRICAL SINGLE LINE: 5-E-13, 5-E-17, AND 5-E-15	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS
ELECTRICAL POWER PLAN: 5-E-101							
CONTROL WIRING: 5-F-23							
GARDNER DENVER CONTROLS: VP1024154							

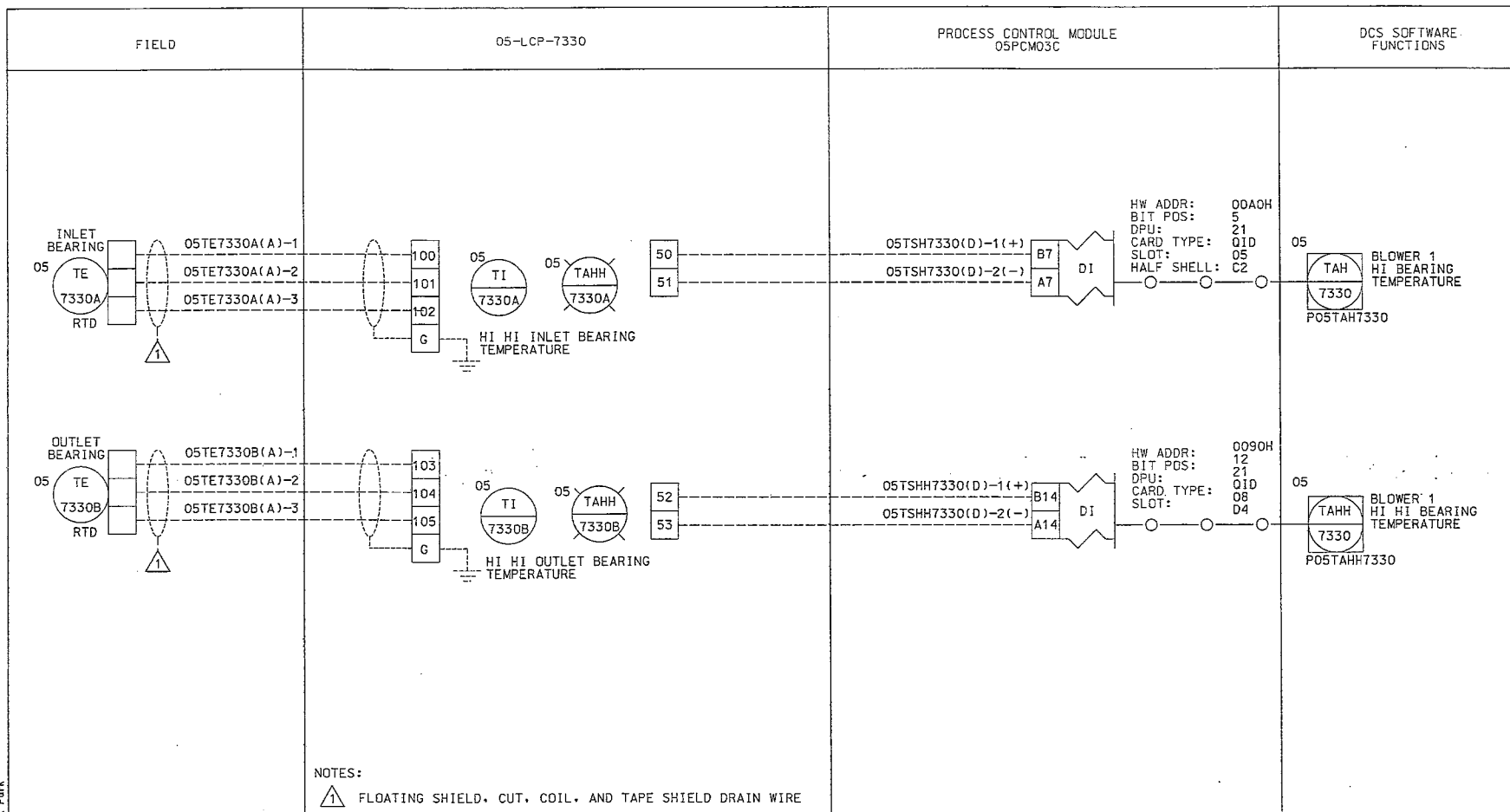


POINT LOMA GRIT AERATION SYSTEMS PROJECT		CIP NO.
METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		46-943.0
INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE GRIT AERATION BLOWER 1 BEARING TEMP		FILE 05T7330.001
LOOP NO. 05T7330	DWG NO. LD-PLWTP05T7330	SHEET 1 OF 3 REV C

PREVIOUS PROJECTS 823-Air Blower Facility Design Select 05T7330.rvt
 8/25/2009 11:34 AM Daniel Park

SAMPLE LOOPS

Pump Station No. 65 - Capacity Upgrade Project
 Building Network Storage Pump & Grinder Installation
 Attachment E - Technicals (Rev. July 2015)



NOTES:
 1 FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE

PREVIOUS PROJECTS\823-Air Blower Facility\Design\elect\05T7330.ref
 Daniel Park
 APPROVED 6/25/2009 1:19:40 PM

SAMPLE LOOPS

Pulp Mill No. 65 Capacity Upgrade Project
 Building 3B Water Storage Pumps & Grinder Installation
 Attachment E - Technicals (Rev. July 2015)

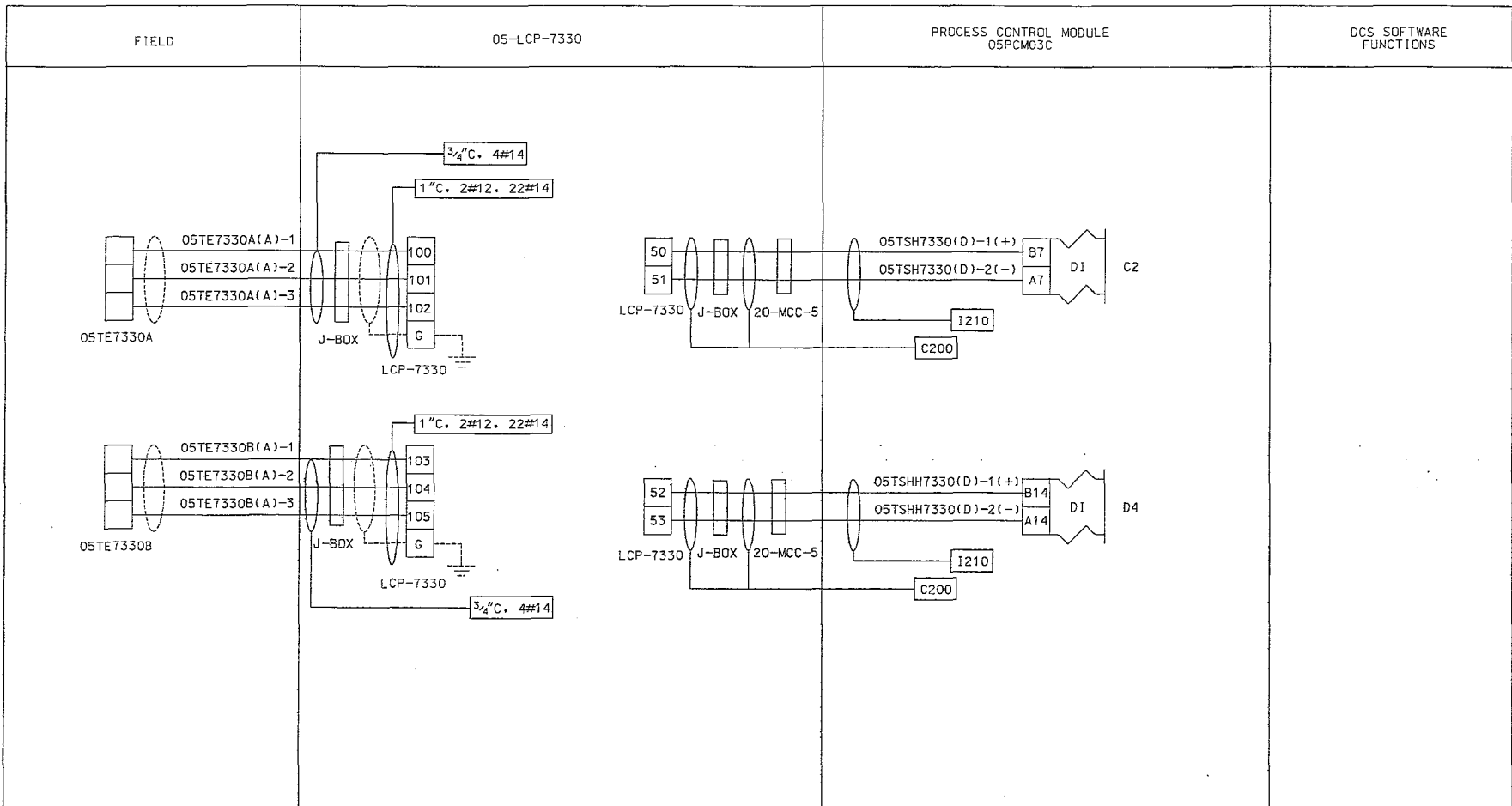
REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL		
P & ID:	5-I-24	REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR
ELECTRICAL/CONDUIT DWG:	5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
FLOW & PIPING PLAN:	5-M-14 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS
ELECTRICAL POWER PLAN:	5-E-101							
CONTROL WIRING:	5-E-23							
GARDNER DENVER CONTROLS:	VP1024154							

LOOP NO.	DWG NO.	SHEET	REV
05T7330	LD-PLWTP05T7330	2 OF 3	C

LEE & RO, Inc.
 San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
 METROPOLITAN WASTEWATER DEPARTMENT
 CITY OF SAN DIEGO, CALIFORNIA
 CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM
 GRIT AERATION BLOWER 1 BEARING TEMP
 FILE 05T7330.002



PROJECT: PREVIOUS PROJECTS 803-Air Blower Facility Design\elec\05T7330.ref
 6/27/2009 1:19:43 PM Daniel Park

REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVAL			
P & ID:	5-I-24	REV.	DATE	DESCRIPTION	BY	CKD	ENGR	MGR	
ELECTRICAL/CONDUIT DWG:	5-E-500	A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS	
FLOW & PIPING PLAN:	5-M-14 & 5-M-100	B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS	
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15	C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS	
ELECTRICAL POWER PLAN:	5-E-101								
CONTROL WIRING:	5-F-23								
GARDNER DENVER CONTROLS:	VP1024154								



POINT LOMA GRIT AERATION SYSTEMS PROJECT METROPOLITAN WASTEWATER DEPARTMENT CITY OF SAN DIEGO, CALIFORNIA		CIP NO.	46-943.0
INTERCONNECTION DIAGRAM GRIT AERATION BLOWER 1 BEARING TEMP		FILE	05T7330.003
LOOP NO.	DWG NO.	SHEET	REV
05T7330	LD-PLWTP05T7330	3 OF 3	C

SAMPLE LOOPS

San Diego Air Blower Capacity Upgrade Project
 Attachment E - Technicals (Rev. July 2015)

SECTION 15000 - PIPING COMPONENTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing fittings, hangers, supports, anchors, expansion joints, flexible connectors, insulation, lining and coating, testing, disinfection, and accessories.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 05500 Miscellaneous Metalwork
2. Section 11000 Equipment General Provisions
3. Section 15010 Mill Piping - Exposed and Buried
4. Section 15020 Pipe Supports

1.3 CODES

- A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. California Mechanical Code
2. California Plumbing Code
3. California Fire Code

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following applies to the WORK of this Section:

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
ANSI/ASME B31.1	Power Piping
ANSI/AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
ANSI/AWWA C150	Thickness Design for Ductile Iron Pipe
ANSI/AWWA C153	Ductile Iron Compact Fittings, 3 In through 24 In and 54 In Through 64 In for Water Service
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in. Through 144 in.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In Through 12 In for Water Distribution
ANSI/AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In through 36 In
ANSI/AWS D10.9	Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing

ASTM A 123	Specification for Zinc Coatings on Iron and Steel Products
ASTM A 536	Ductile Iron Castings
ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop drawings showing dimensions and details of pipe joints, fittings, fitting specials, valves and appurtenances.
2. Detailed layout, spool, or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings, and pipe supports.
 - a. Pipe layout drawings shall show all pipe supports with a legend, label, or other marking to clearly indicate what support type is being used at each support location in conformance with specification 15020.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's product data.
2. Manufacturer's installation instructions.
3. Manufacturer's certification of compliance.
4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.
5. Outline of Quality Control Program.

1.7 INSPECTION, TESTING AND WELDING

- A. **Inspection:** Products shall be inspected at the manufacturer's plant.
- B. **Tests:** Materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.
- C. **Welding Requirements:** Welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D10.9. Welding procedures shall be required for longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- D. **Welder Qualifications:** Welding shall be performed by skilled operators who have had adequate experience in the methods and materials to be used and have been qualified under the provisions of ANSI/AWS D10.9 by an independent approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.

1.8 FACTORY TESTING

- A. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements.
- B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.
- B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Miscellaneous Small Pipes:** Miscellaneous small pipes and fittings shall comply with Section 15010.
- B. **Pipe Supports:** Pipes shall be properly supported in accordance with Section 15020.
- C. **Coating:** Pipes above ground or in structures shall be color-code field-painted. Colors shall be as selected by the CONSTRUCTION MANAGER.
- D. **Pressure Rating:** Except as otherwise indicated, piping systems shall be designed for 150 percent of the maximum indicated pressure.
- E. **Grooved Piping Systems:** Grooved couplings on buried piping must be bonded. Grooved fittings, couplings, and valves shall be from the same manufacturer.

2.2 PIPE FLANGES

- A. **Flanges:** Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-lb class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-lb class. Flanges shall be attached to the pipe in accordance with ANSI/AWWA C207.
- B. **Blind Flanges:** Blind flanges shall comply with ANSI/AWWA C207. Blind flanges for pipe sizes 12 inches and larger shall include lifting eyes in form of welded or screwed eye bolts.
- C. **Flange Coating:** Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- D. **Flange Bolts:** Bolts and nuts shall comply with Section 05500. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs may be used only on valve flange connections where space restrictions preclude the use of regular bolts.

- E. **Insulating Flanges:** Insulated flanges shall have bolt holes 1/4-inch diameter greater than the bolt diameter. Existing flanges where new insulating gaskets are required for the project may require boring the holes greater or replacement of the flanges at no additional cost to the CITY.
- F. **Insulating Flange Sets:** Insulating flange sets shall be provided where indicated and shall consist of insulating gaskets (retainer), insulating bolt sleeves, and double insulating washers. All insulating components shall be NEMA G-10 epoxy glass. Insulating gaskets (retainers) shall be full face, Type E and shall have a Buna-N (nitrile) O-ring type sealing element such as PSI Linebacker or equal.

Insulating flange kits shall be tested and inspected by the City's Corrosion Engineer. The City's Corrosion Engineer shall be contacted at (858) 614-5560 a minimum of 48 hours prior to the assembly of any insulating flange kits. Insulating flange kits shall be installed and tested in accordance with NACE SP0286-07. Insulating flange kits shall be tested using a minimum of two test methods. The first test method shall utilize a Gas Electronics Model 601 Insulator Checker specifically designed for testing insulating flanges. Additionally, insulating flanges shall be tested by measuring pipe-to-soil potentials on either side of the insulating joint as described in SP02186-07 Paragraph 9.2.2.

The installation of the insulating flange kit shall be considered complete when the testing above indicates that no shorts or partial shorts are present. Any insulating flange kit that is determined to be ineffective shall be repaired or replaced at the CONTRACTOR'S expense.

- G. **Flange Gaskets:** Gaskets for flanged joints shall be full-face, 1/8-inch thick sheets of neoprene, suitable for temperatures to 550 degrees F, a pH of 0 to 14, and pressures to 1400 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.

2.3 THREADED INSULATING CONNECTIONS

- A. **General:** Threaded insulating bushings, unions, and couplings shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are indicated.
- B. **Materials:** Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties suitable for the service and loading conditions indicated.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

- A. **General:** Cast mechanical-type couplings shall be provided where shown. Bolts and nuts shall conform to Section 05500. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations suitable for the highest pressure indicated.

2.5 SLEEVE-TYPE COUPLINGS

- A. **Construction:** Sleeve-type couplings shall be installed where indicated and shall include steel bolts, without pipe stop, and shall be sized to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7 inches long for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be

of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to Section 05500. Buried sleeve-type couplings shall be epoxy-coated at the factory.

- B. **Pipe Preparation:** The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.
- C. **Gaskets:** Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall comply with the following:
1. Color - Jet Black
 2. Surface - Non-blooming
 3. Durometer Hardness - 74 ± 5
 4. Tensile Strength - 1000 psi Minimum
 5. Elongation - 175 percent Minimum

The gaskets shall resist deterioration caused by impurities normally found in water or wastewater. Gaskets shall comply with ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as otherwise indicated. Gaskets shall be compatible with the piping service and fluid utilized.

- D. **Insulating Couplings:** Where insulating couplings are indicated, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to insulate coupling metal parts from the pipe.

E. **Restrained Joints:**

1. Harnesses for flexible sleeve type couplings shall be in accordance with the requirements of the appropriate reference standards and standard practices.
2. Mechanical and Push-On Joints: Restraints shall be provided where shown and may be provided in lieu of concrete thrust blocks.
 - a. Mechanical joint restraint mechanisms shall consist of individually activated multiple gripping devices which incorporate breakoff actuating units and permanent nuts for future disassembly. Pressure ratings shall be:
 - (1) Ductile Iron Pipe
 - (a) 3 to 6 inch diameter: 350 psi (2:1 safety factor)
 - (b) 18 to 48 inch diameter: 250 psi (2:1 safety factor)
 - (2) PVC Pipe
 - (a) 3 to 36 inch diameter: full pressure rating or pressure class of pipe (2.5:1 safety factor)
 - b. Push-on joints for steel pipes shall be in accordance with the appropriate reference standards and standard practice.

- c. Restrained push-on joints for all other pipe materials shall be comprised of two rings with connecting rods. The restraint ring shall be on the spigot, and a plain or slit bell ring shall be on the bell. Pressure ratings shall be:
 - (1) Ductile Iron Pipe
 - (a) 3 to 16 inch diameter: 350 psi (2:1 safety factor)
 - (b) 18 to 48 inch diameter: 250 psi (2:1 safety factor)
 - (2) PVC Pipe
 - (a) 3 to 10 inch diameter: 200 psi (4:1 safety factor)
 - (b) 12 inch diameter: 150 psi (4:1 safety factor)
 - (c) 14 to 16 inch diameter: 235 psi (2:1 safety factor)
 - (d) 18 to 30 inch diameter: 165 psi (2:1 safety factor)
 - (e) 36 inch diameter: 125 psi (2:1 safety factor)
 - (3) Dimensions of push-on bell restraints shall be compatible with ANSI/AWWA C150 and C900 or C905 for ductile iron or PVC pipe, respectively.
- d. Restraint glands shall be of ductile iron conforming to ASTM A 536. Dimensions of the glands shall be compatible with standard mechanical joint bell and tee head bolts conforming to ANSI/AWWA C111 and C153, respectively.
- e. Bolts and nuts shall conform to Section 05500.

2.6 FLEXIBLE CONNECTORS

- A. Flexible connectors shall be provided in all piping connections to engines, pumps, blowers, compressors, vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 180 degrees F shall be flanged reinforced neoprene or butyl rubber spools, rated for working pressures of 40 to 150 psi or reinforced flanged rubberized duck, as best suited for the application. For temperatures above 180 degrees F, flexible connectors shall be flanged braided Type 316 stainless steel spools with inner corrugated stainless steel hose rated for minimum 150 psi working pressure unless indicated otherwise. Connectors shall be minimum of 9 inches face to face between flanges. Material selection shall be proposed by the manufacturer based on the application.

2.7 EXPANSION JOINTS (NOT USED)

2.8 PIPE THREADS

- A. Pipe threads shall comply with ANSI/ASME B1.20.

2.9 PIPE INSULATION (NOT USED)

2.10 AIR AND GAS TRAPS (NOT USED)

2.11 STEAM TRAPS (NOT USED)

2.12 GLASS LINING (NOT USED)

2.13 MANUFACTURERS

A. **Manufacturers:** Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1. **Insulating Flanges:**

JM Red Devil, Type E
Maloney Pipeline Products Co.
PSI Products, Inc.

2. **Flange Gaskets:**

John Crane, Style 2160
Garlock, BLUE-GARD® Style 3000

3. **Steel Pipe Couplings:**

Gustin-Bacon (banded or grooved)
Victaulic Vic-Ring® Style 41 or 44 (banded)
Victaulic Style 77 or Zero-Flex® Style 07 (grooved)

4. **Ductile Iron Pipe Couplings:**

Gustin-Bacon
Victaulic Style 31

5. **Couplings for PVC Pipe:**

Gustin-Bacon
Victaulic Style 775

6. **Sleeve-Type Couplings:**

Dresser, style 38
Ford Meter Box Co., Inc., Style FC1 or FC3
Smith-Blair, Style 411

7. **Dismantling Joints:**

Romac Industries, Inc DJ400
Smith-Blair, Inc 970 Series

PART 3 -- EXECUTION

3.1 GENERAL

A. Pipes, fittings, and appurtenances shall be installed in accordance with the manufacturer's installation instructions.

**** END OF SECTION ****

SECTION 15010 - MILL PIPING - EXPOSED AND BURIED

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing small steel pipe, stainless steel pipe and tubing, red brass pipe, copper pipe and tubing, solvent-welded PVC pipe, CPVC pipe, fiber glass reinforced plastic pipe, process glass pipe, ductile iron pipe, cast iron soil pipe, and corrosion-resistant cast iron pipe with fittings, gaskets, bolts, insulating connections, pipe insulation, and other specialties required for an operable piping system.

1.2 RELATED SECTIONS

- A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15000 Piping Components

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ANSI/ASME B16.3 Malleable Iron Threaded Fittings, Classes 150 and 300
2. ANSI/ASME B16.4 Cast Iron Threaded Fittings, Class 125 and 250
3. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
4. ANSI B16.11 Forged Steel Fittings, Socket-Welding and Threaded
5. ANSI B16.12 Cast-Iron Threaded Drainage Fittings
6. ANSI/ASME B16.15 Cast Bronze Threaded Fittings, Classes 125 and 250
7. ANSI B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
8. ANSI B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
9. ANSI/ASME B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings
10. ANSI A21.10 Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids
11. ANSI A21.51 Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
12. ASTM A 53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
13. ASTM A 74 Specification for Cast Iron Soil Pipe and Fittings

- | | | |
|-----|-------------|-----------------------------------------------------------------------------------------------------------|
| 14. | ASTM A 105 | Specification for Forgings for Piping Components |
| 15. | ASTM A 106 | Specification for Seamless Carbon Steel Pipe for High Temperature Service |
| 16. | ASTM A 269 | Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service |
| 17. | ASTM A 312 | Specification for Seamless and Welded Austenitic Stainless Steel Pipe |
| 18. | ASTM A 518 | Specification for Corrosion-Resistant High-Silicon Iron Castings |
| 19. | ASTM B 42 | Specification for Seamless Copper Pipe, Standard Sizes |
| 20. | ASTM B 43 | Specification for Seamless Red Brass Pipe, Standard Sizes |
| 21. | ASTM B 62 | Specification for Composition Bronze or Ounce Metal Castings |
| 22. | ASTM B 88 | Specifications for Seamless Copper Water Tube |
| 23. | ASTM C 599 | Specification for Process Glass Pipe and Fittings |
| 24. | ASTM D 1785 | Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| 25. | ASTM D 2996 | Specification for Filament-Wound Reinforced Thermosetting Resin Pipe |
| 26. | ASTM D 4101 | Specification for Propylene Plastic Injection and Extrusion Materials |
| 27. | ASTM F 441 | Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 |

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's written certification that all products comply with the contract requirements.
2. Manufacturer's product specifications and performance information.
3. Shop drawings showing fabrication details, dimensions, fittings, coatings, and all information pertaining to the fabrication or installation of provided pipe.

PART 2 -- PRODUCTS

2.1 SMALL STEEL PIPE

- A. Unless otherwise indicated, galvanized steel pipe and black steel pipe in sizes 6 inches in diameter and smaller shall conform to the requirements of ASTM A 53 and ASTM A 106 and shall be Schedule 40 or 80 as indicated. Fittings for galvanized steel pipe shall be of galvanized

malleable iron, with NPT or grooved ends as indicated. Black pipe may have welded joints, with standard or extra strong welded fittings unless otherwise indicated in the Piping Schedule.

2.2 STAINLESS STEEL PIPE

- A. Unless otherwise indicated, stainless steel pipe shall be Type 316 Schedule 40 threaded pipe conforming to ASTM A 312 with stainless steel threaded fittings, or with stainless steel welded fittings, where indicated. All welded stainless steel shall be passivated after welding per Specification Section 05500. Lightweight stainless steel pipe shall be Type 316 Schedule 10 pipe conforming to ASTM A 312, with stainless steel welding fittings. All threaded piping shall include 316 stainless steel unions located, at a minimum, at all pieces of equipment, valves, or other areas where maintenance occurs.

2.3 STAINLESS STEEL TUBING

- A. Stainless steel tubing shall be made of Type 316 L stainless steel to the requirements of ASTM A 269, of minimum 1/4-inch inside diameter, or as indicated, for the test pressure required. The fittings shall be swage ferrule design of Type 316 L stainless steel, of the double acting ferrule design, providing both a primary seal and a secondary bearing force. Flare bite or compression type fittings are not acceptable.

2.4 RED BRASS PIPE (NOT USED)

2.5 COPPER PIPE

- A. Copper pipe shall be hard drawn, to the requirements of ASTM B 42, with regular or extra strong wall thickness, as required for the test pressure. Copper pipe shall have screwed ends for NPT fittings, or brazed joints. The fittings shall be threaded cast bronze fittings to the requirements of ANSI/ASME B16.15, class 125 or 250, as required, or flanged cast copper alloy fittings to the requirements of ANSI/ASME B16.24, with 150 lbs rating, or as required.

2.6 COPPER TUBING

- A. Copper tubing shall conform to the requirements of ASTM B 88 and shall be Type K, soft temper for buried tubing and hard drawn for above-ground application. Fittings shall be soldered or sweated on and shall be of wrought copper conforming to ANSI B16.22. Soldered joints shall contain 95-percent tin and 5-percent antimony. For oxygen service, joints shall be made with silver solder. No solders or fluxes containing more than 0.2 percent of lead shall be used.

2.7 POLYVINYL CHLORIDE PRESSURE PIPE, SOLVENT-WELDED

- A. Polyvinyl chloride pressure pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 80, conforming to ASTM D 1785, unless otherwise indicated. Elbows and tees shall be of the same material as the pipe. Joint design shall be for solvent-welded construction.

2.8 CHLORINATED POLYVINYL CHLORIDE PRESSURE PIPE, SOLVENT-WELDED (NOT USED)

2.9 POLYPROPYLENE PIPE (NOT USED)

2.10 PROCESS GLASS PIPE (NOT USED)

2.11 FIBERGLASS REINFORCED PLASTIC PIPE (NOT USED)

2.12 CAST IRON SOIL PIPE (NOT USED)

2.13 CORROSION-RESISTANT CAST IRON SOIL PIPE (NOT USED)

2.14 DUCTILE IRON PIPE

- A. Ductile iron pipe and fittings shall be in accordance with SSPWC, Subsection 207-9 and the requirements contained herein. The pipe shall be of the diameter and class indicated. Pipe materials shall conform to the requirements of SSPWC, Subsection 207-9.2, and AWWA C151.
- B. Ductile iron pipe joints shall comply with the requirements of SSPWC, Subsection 207-9.2.2 and shall be of the type indicated. Restrained joints shall be an approved type provided and recommended by the pipe manufacturer.
- C. Polyethylene sleeves shall not be used.
- D. Special Fittings: Fittings of the compact type for ductile iron pipe shall conform to the requirements of AWWA C153/ANSI A21.53, and shall have a minimum pressure rating of 250 psi.
- E. Fusion Bonded Epoxy Coating and Lining for Ductile Iron Pipe: Ductile iron pipe, fittings, and specials shall be lined and coated with fusion bond epoxy. The powder shall be applied to the preheated pipe at a uniform cured thickness. The minimum uniform cured thickness of the applied material shall be 16 mils and 14 mils for Interior and Exterior surface respectively.
- F. Fusion Bond Epoxy Manufacturers:
 - 1. Scotchkote
 - 2. Lilly Powder Coatings
 - 3. HB Fuller
 - 4. or equal

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. **General:** Mill piping shall be installed in accordance with the manufacturer's installation instructions.
- B. **Plastic Pipe:** PVC, CPVC, and FRP pipe joints shall be solvent-welded in accordance with the manufacturer's instructions. Expansion joints or pipe bends shall be installed to absorb pipe expansion over a temperature range of 100 degrees F, unless otherwise indicated. Care shall be taken to provide sufficient supports, anchors, and guides, to eliminate stress on the piping.

**** END OF SECTION****

SECTION 15020 - PIPE SUPPORTS

PART 1-- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing pipe supports, hangers, guides, and anchors.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 1. Section 05500 Miscellaneous Metalwork
 2. Section 15000 Piping Components

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B31.1	Power Piping
ANSI/MSS SP-58	Standard Pipe Support Components

1.4 SHOP DRAWINGS AND SAMPLES

- A. Submittals shall comply with Section 15000 and shall include:
 1. Shop drawings of pipe supports including details of concrete inserts.
 2. Manufacturer's catalogue information demonstrating compliance with the specifications.
 3. Hanger and support location drawings with a legend that lists at a minimum, support identification number, support type, seismic restraint locations, anchor locations, pipe size, service and weight.
 4. Seismic restraint calculations signed by an engineer registered in California.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. **General:** Piping systems including connections to equipment shall be properly supported to prevent deflection and stresses. Supports shall comply with ANSI/ASME B31.1, except as otherwise indicated.
- B. **ANSI/MSS Types:** Except as otherwise indicated, pipe support components shall comply with the types in ANSI/MSS SP-58.

- C. **Material:** Unless otherwise indicated, all pipe supports components and hardware shall be stainless steel type 316.
- D. **Support Spacing:** Supports for horizontal piping shall be properly spaced. Except as otherwise indicated, pipe support spacing shall comply with the following:

1. Support Spacing for Schedule 40 & 80 Steel Pipe:

Pipe Size (inches)	Max. Span (feet)
1/2	6
3/4 & 1	8
1-1/4 to 2	10
3	12
4	14
6	17
8 & 10	19
12 & 14	23
16 & 18	25
20 & Above	30

2. Support Spacing for Copper Tubing:

Tube Size (inches)	Max. Span (feet)
1/2 to 1-1/2	6
2 to 4	10
6 & Above	12

3. Support Spacing for Schedule 80 PVC Pipe:

Pipe size (inches)	Max Span (@100 degrees F) (feet)
1/2	4
3/4	4
1	5
1-1/4	5
1-1/2	5
2	6
3	7
4	8
6	10
8	11
10	12
12	13

4. Support Spacing for Welded, Fabricated Steel Pipe:

Practical Safe Spans for Simply Supported Pipe in
120-deg Contact Saddles

Nominal Size in.	Wall Thickness-in									
	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
24	33	37	40	43	45	47				
26	33	37	41	43	45	47				
28	33	38	41	44	46	48				
30	34	38	41	44	47	49				
32	34	38	42	45	47	50				
34	34	38	42	45	48	50				
36	34	39	42	45	48	50	54			
38	34	39	43	46	48	51	55			
40	34	39	42	46	49	51	55			
42	35	39	43	46	49	52	56			
45		39	43	47	50	52	56			
48		40	44	47	50	53	57	61		
51		40	44	47	50	53	58	61		
54		40	44	47	51	53	58	62		
57		40	44	48	51	54	58	62		
60		40	44	48	51	54	59	63	66	69
63		40	44	48	51	54	59	63	67	70
66		40	45	48	52	54	59	64	67	71
72		41	45	49	52	55	60	64	68	72
78		41	45	49	52	55	61	65	69	72
84		41	45	49	53	56	61	66	70	73
90		41	45	49	53	56	61	66	70	74
96		41	46	50	53	56	62	67	71	75

For steel pipe sizes not indicated, the support spacing shall be designed to ensure that the stress on the pipe does not exceed 5,000 psi calculated from the following formula:

$$L = \frac{7500tD}{32t+D}$$

t = thickness, in.
 D = Diameter, in.
 L = Safe span, ft.

Maximum deflection of pipe shall be limited to 1/360th of the span.

5. Support Spacing for Ductile Iron Pipe:

<u>Pipe Size</u>	<u>Max. Span</u>
All Sizes	2 Supports per length or 10 feet (One of the 2 supports located at joint)

6. **Variations:** For temperatures other than ambient temperatures and for other piping materials or wall thicknesses, the above spacings shall be modified in accordance with the pipe manufacturer's recommendations.

7. **Additional Supports:** Additional supports complying with ANSI B31.1 shall be provided at critical elbows, valves, gauges, and meters.
- E. **Pipe Hangers:** Pipe hangers shall be capable of supporting the pipe, shall allow for free expansion and contraction of the piping, and shall prevent excessive stress on equipment. Hangers shall have a means of vertical adjustment after erection. Hangers shall be designed so that they cannot become disengaged by any movement of the pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading, only.
- F. **Hangers Subject to Horizontal Movements:** At hanger locations where lateral or axial movement is indicated, suitable linkage shall be provided to permit movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from minimum to maximum temperature, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.
- G. **Spring-Type Hangers:** Spring-type pipe hangers shall be provided for piping where vibration or vertical expansion and contraction is indicated, (engine exhausts and similar piping). Spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions indicated. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. Supports shall be designed for a maximum variation of 25 percent for the total travel resulting from thermal movement.
- H. **Thermal Expansion:** Wherever expansion and contraction of piping is indicated, a sufficient number of expansion loops or joints shall be provided, with rolling or sliding supports, anchors, guides, pivots, and restraints. They shall permit the piping to expand and contract freely in directions away from the anchored points and shall be structurally suitable to withstand all loads imposed.
- I. **Heat Transmission:** Supports, hangers, anchors, and guides shall be designed and insulated so that excessive heat shall not be transmitted to the structure or to other equipment.
- J. **Riser Supports:** Risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.
- K. **Freestanding Piping:** Free-standing pipe connections to equipment, including chemical feeders and pumps, shall be firmly attached to fabricated steel frames made of angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands, consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps installed to secure piping.
- L. **Point Loads:** Meters, valves, heavy equipment, and other point loads on PVC, and other plastic pipes, shall be supported on both sides according to manufacturer's recommendations to avoid pipe stresses. Supports on plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

- M. **Noise Reduction:** To reduce transmission of noise in piping systems, copper tubes shall be wrapped with a 2-inch wide strip of rubber fabric at each pipe support, bracket, clip, and hanger.
- N. **Structural Design:** Pipe supports, anchors, and restrainers shall be designed for static, dynamic, wind, and seismic loads. The horizontal seismic design force shall be the greater of that indicated in the project Geotechnical Report or the requirement of the CBC for Seismic Zone 4.

2.2 COATING

- A. **Galvanizing:** Fabricated pipe products, except stainless steel or non-ferrous supports, shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM 123.

2.3 MANUFACTURERS

- A. Pipe supports shall be manufactured by one of the following (or equal):

Basic Engineers
Bergen-Paterson Corp.
ITT-Grinnell Corp.
NPS Industries, Inc.
Powerstrut
Unistrut

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. **General:** Pipe supports, hangers, brackets, anchors, guides, and inserts shall be installed in accordance with the manufacturer's installation instructions and ANSI/ASME B31.1.
- B. **Appearance:** Supports and hangers shall be installed to produce an orderly, neat piping system. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings as possible and without interference with other work.

** END OF SECTION **

SECTION 15030 - PIPING IDENTIFICATION SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing identification devices for all piping and valves using color bands, lettering, flow direction arrows, and related permanent identification devices, and all appurtenant works. The WORK of this Section also includes providing identification devices for all hazardous materials storage and conveyance facilities.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Divisions 11, 13, 15 Piping, Valves, and Appurtenances, as applicable

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI A13.1	Scheme for the Identification of Piping Systems
ANSI Z535.1	Safety Color Code
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
NFPA	Guide to Hazardous Materials
NFPA 704	Hazard Identification System
UFC 79-3	Identification of the Health, Flammability and Reactivity of Hazardous Materials
29CFR 1910.106	Flammable and Combustible Liquids (OSHA)
29CFR 1910.145	Specification for Accident Prevention Signs and Tags (OSHA)
29CFR 1910.1200	Hazard Communication (OSHA)

1.4 CODES

- A. The WORK of this Section shall comply with the following codes in the California Code of Regulations (CCR):

CCR, Title 8, § 537	Piping Systems Valving and Labeling (Cal-OSHA)
CCR, Title 8, § 3321	Identification of Piping (Cal-OSHA)
CCR, Title 8, § 5194	Hazard Communication (Cal-OSHA)

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:

1. Samples of all types of identification devices to be used in the WORK.
2. A list of suggested wording for all valve tags.

PART 2 -- PRODUCTS

2.1 IDENTIFICATION OF EXPOSED PIPING

- A. Identification of all exposed interior and exterior pipe, including pipe in accessible ceiling spaces, pipe trenches, pipe chases, vaults and valve boxes, shall be accomplished by complete color coded painting of all visible pipe and its insulation. Provide color coded painting, marker lettering and color banding to match existing. Stainless steel pipe shall be color coded utilizing bands at 20 feet intervals as specified for identification of hazardous substance conveyance facilities in CCR, Title 8, Section 3321.
- B. Each pipe identification shall consist of a printed pipe marker identifying the name of the pipe and a flow arrow to indicate direction(s) of flow in the pipe. All markers shall be preprinted. Markers shall be the mechanically attached types that are easily removable; they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Fasteners shall be non-metallic. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C. Markers shall withstand a continuous operating temperature range of minus 40 degrees F to 200 degrees F. Plastic coding markers shall not be the individual letter type, but shall be manufactured and applied in one continuous length of plastic.
- C. Marker and letter sizes shall conform to ANSI A13.1 except as otherwise indicated for hazardous materials identification. Directional arrows shall be the same size as the lettering.
- D. Except as otherwise indicated for hazardous materials identification, markers shall be white with black letters and directional arrows, except for pipes painted white, on which markers shall be blue with white letters.
- E. Pipelines which convey hazardous materials and hazardous materials storage facilities shall be labeled in full conformance with the Cal-OSHA and Federal OSHA regulatory standards, and the guidelines provided in UFC 79-3 and NFPA 704. As a minimum, pipeline identification shall include the chemical name and an appropriate hazard warning using words, pictures, symbols, or a combination thereof to identify flammability, health and reactivity. Placards may be used for hazard warnings, if affixed to the pipes.

2.2 IDENTIFICATION OF EXPOSED VALVES AND SHORT PIPE LENGTHS

- A. Identifying devices for valves, and the sections of pipe that are too short to be identified with preprinted markers, and arrows, shall be plastic tags.
- B. Plastic tags shall be engraved. The minimum tag thickness shall be 1/6-inch; the minimum size of 2-1/2-inch by 2-1/2-inch with 5/32-inch diameter top holes. Color shall be white with black lettering. Minimum lettering height shall be 1/4-inch. All tags shall be designed to be firmly attached to the valves or short pipes or to the structure immediately adjacent to such valves or short pipes.

2.3 LOCATION MARKING OF BURIED PIPES (N/A)

2.4 EXISTING IDENTIFICATION SYSTEMS

- A. In installations where existing piping identification systems have been established, the CONTRACTOR shall continue to use the existing system for pipes which convey non-hazardous materials. Where existing identification systems are incomplete, utilize the existing system as far as practical and supplement with the indicated system. The objective is to fully identify all new piping, valves, and appurtenances to the level indicated herein.

2.5 MANUFACTURERS

- A. Products of the type indicated shall be manufactured by the following (or equal):
 - 1. W.H. Brady Co.
 - 2. Seton Nameplate Corp.

PART 3 -- EXECUTION

3.1 GENERAL

- A. All markers and identification tags shall be installed in accordance with the manufacturer's printed instructions, and shall be neat and uniform in appearance. All such tags or markers shall be readily visible from all normal working locations.

3.2 VALVE TAGS

- A. Valve tags shall be attached to the valve or structure by means of self-locking plastic or nylon ties.
- B. Wording on the valve tags shall include both the valve number and a description of the exact function of each valve, e.g., "DHWB-BALANCING," "CLS THROTTLING", "RAS-PUMP SHUT-OFF," etc.

3.3 EXPOSED PIPE IDENTIFICATION

- A. Each exposed pipe shall be identified at intervals of 20 feet, and at least one time in each room. Piping shall also be identified at a point approximately within 2 feet of all turns, ells, valves, and on the upstream side of all distribution fittings or branches. Sections of pipe that are too short to be identified with lettered markers, and directional arrows shall be tagged and identified similar to valves.
- B. Pipe identification shall consist of two to four elements: color coating and/ or banding of the pipe, a lettered marker with a directional arrow; and a hazard warning for pipelines which convey hazardous materials.

3.4 EXPOSED PIPE IDENTIFICATION SCHEDULE

- A. Application of the pipe identification systems shall conform to the following color codes. Marker lettering shall conform to that listed under "Function and Identification." Some piping may not be used in this contract.

<u>Fluid Abbreviation</u>	<u>Function and Identification</u>	<u>Identification Color</u>	<u>Remarks Suggested Tnemec Color or Equal</u>
CA	Compressed Air	Off-White	Barbados PA24
D	Drain	See Remarks	Same color corresponding to service fluid
IA	Instrument Air	Off-White	Barbados PA24
W2	Industrial Water	Light Blue	Clear Sky EN17
PSL	Primary Sludge Line	Brown	Match existing
W1	Potable Water	White	White WH01

** END OF SECTION **

SECTION 15034 - GAUGES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing pressure and vacuum gauges, including fittings, snubbers, connections, gaskets, supports, and accessories.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

- 1. Section 11000 Equipment General Provisions

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

- 1. California Plumbing Code

PART 2 -- PRODUCTS

2.1 PRESSURE AND VACUUM GAUGES

- A. **General:** Pressure gauges shall be installed on suction and discharge connections to pumps; on discharge connections from blowers and compressors; at each side of pressure reducing valves; and where otherwise indicated. Vacuum gauges and compound gauges, where indicated, shall be installed on vacuum pumps.
- B. **Gauge Construction:** Gauges shall have Type 316 stainless steel movement and stainless steel or alloy case. Except as otherwise indicated, gauges shall have a 3-1/2-inch dial, 1/4-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gauges shall be calibrated to read with an accuracy of 1 percent to 150 percent of the indicated pressure. Gauges shall be vibration and shock resistant. Gauges on liquid service should have cases filled with a suitable liquid.
- C. **Diaphragm Seal:** N/A

2.2 SLEEVE PRESSURE GAUGES

- A. **General:** Sleeved pressure gauges shall be provided where indicated.
- B. Sensors shall be in-line ring-type, bolted directly between 600 lb R.F. flanges. The sensors shall have through-holes for positive alignment with pipeline flanges. Inside diameters of the sensors shall be the same as the mating pipes. Pressure sensing rings shall measure pressure for 360 degrees around the inside circumference of the pipe. Pressure shall be transmitted to the gauge by a locked-in, sealed ethylene glycol or silicone oil. The pressure indicators shall be local to the sensors. Pressure transmitters shall be connected by capillary tubing to the sensors.

2.3 MANUFACTURERS

A. Pressure and Vacuum Gauges

1. **Pressure and vacuum gauges shall be manufactured by one of the following (or equal):**

Ashcroft Industrial Instruments (Dresser)
Foxboro/Jordan, Inc.
Marsh Instrument Company
Marshalltown Instruments, Inc.
U.S. Gauge Div. of Ametek

B. Sleeve Pressure Gauges:

1. **Sleeve pressure gauges shall be manufactured by one of the following (or equal):**

Red Valve Company, Inc.
Ronningen-Petter

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Gauges shall be installed in accordance with the manufacturer's installation instructions.
- B. Gauges shall be installed with the face in the vertical position at the indicated locations. Gauges shall be installed to minimize the effect of water hammer and vibrations, and, where indicated, gauges shall be mounted independently, with flexible connectors.

**** END OF SECTION ****

SECTION 15106 - BALL VALVES

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing manually-operated ball valves with epoxy coating, operators, and accessories.

1.2 FACTORY TESTING

- A. Valves shall be tested in compliance with AWWA C507.
- B. Proof-of-design tests shall be submitted for all ball valves size 6-inch and larger.

PART 2 – PRODUCTS

2.1 BALL VALVES (6-INCH AND LARGER) (NOT USED)

2.2 BALL VALVES (4-INCH AND SMALLER)

- A. **General Requirements:** Except as otherwise indicated, ball valves in sizes up to 4 inches shall have manual operators with lever or handwheel. Ferrous surfaces of valves where contact with water is indicated shall be epoxy-coated.
- B. **Body:** Ball valves up to 1-1/2 inches in size shall have bronze or forged brass 2- or 3-piece bodies with ends threaded and shall be designed for a pressure rating of not less than 300 psi. Valves 2- inch to 4-inch in size shall have bronze forged brass or steel 2-or 3-piece bodies with flanged ends and shall be designed for a pressure rating of 150 psi.
- C. **Balls:** The balls shall be fabricated of solid brass, chrome plated bronze, or Type 316 stainless steel, with full openings.
- D. **Stems:** The valve stems shall be of the blow-out proof design, and fabricated of bronze or Type 316 stainless steel and shall include reinforced Teflon seals.
- E. **Seats:** The valve seats shall be of Teflon or Buna-N.

2.3 PLASTIC BALL VALVES (N/A)

2.4 MANUFACTURERS

- A. Ball valves shall be manufactured by the following (or equal):
 - 1. Ball Valves (6-inch and Larger): (NOT USED)
 - 2. Ball Valves (4-inch and Smaller):

Jamesbury Corporation

Jenkins Bros.
Lunkenheimer Flow Control
Wm. Powell Company
Worcester Controls

3. Plastic Ball Valves: (N/A)

PART 3- EXECUTION (NOT USED)

**** END OF SECTION****

SECTION 15115 - MISCELLANEOUS VALVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing miscellaneous valves as indicated, complete and operable, including accessories and operators.

PART 2 -- PRODUCTS

2.1 BACKFLOW PREVENTER VALVES (NOT USED)

2.2 SEWAGE SURGE RELIEF VALVES (NOT USED)

2.3 PRESSURE RELIEF VALVES

- A. **Valve Construction:** Pressure relief valves, unless otherwise indicated, shall have a minimum pressure rating of 250 psi, bronze, steel, or stainless steel bodies, adjustable spring action, screwed connections, and trim to suit primary sludge applications. They shall be set for 90 psi pressure or as directed by Construction Manager.

2.4 CORPORATION STOPS (NOT USED)

2.5 PINCH VALVES (NOT USED)

2.6 MANUFACTURERS

- A. Products of the type or model indicated shall be manufactured by one of the following (or equal):
1. Backflow preventer valves (Not Used)
 2. Sewage surge relief valves (Not Used)
 3. Pressure relief valves
A.W. Cash Valve Mfg. Corp.
Consolidated (Dresser Industries Valve Division)
Watts Regulator Company
 4. Corporation stops (Not Used)
 5. Pinch valves (Not Used)

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. All valves shall be installed in accordance with the manufacturer's printed recommendations.

** END OF SECTION **

SECTION 16030 - ELECTRICAL TESTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes testing, commissioning and demonstrating electrical WORK.
- B. The WORK of this Section includes circuit activation, equipment running and installation of temporary jumpers.
- C. The WORK of this Section includes correction of defects and retesting.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 13300 Instrumentation and Control
 - 2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

- A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:
 - 1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. NETA National Electrical Testing Association, Latest Edition

1.5 SEQUENCE AND SCHEDULING

- A. Electrical testing including functional testing of power and controls not tested under Section 13300 shall be completed before commencement of commissioning.

1.6 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. Report of testing of electrical WORK.

PART 2 -- PRODUCTS

2.1 TEST EQUIPMENT AND MATERIALS

- A. Test instruments shall be calibrated to references traceable to the National Bureau of Standards and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

PART 3 -- EXECUTION

3.1 TESTING

- A. In addition to indicated testing requirements and acceptance criteria, testing shall include the following:
 - 1. **Lighting:** N/A
 - 2. **Power Instrumentation:** N/A
 - 3. Demonstration of mechanical and electrical interlocking by attempting to subvert the indicated sequence.
 - 4. Activation of ground fault tripping by operating test features provided with ground current protective systems and by injecting a known, and reasonable, current in the ground current sensor circuit. Where not otherwise indicated, ground fault tripping shall occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amperes or less.
 - 5. **Cable Testing:** 480-volt circuits shall be tested for insulation resistance with a 1000-volt megohm meter. Testing shall be done after the 480-volt equipment is terminated.
 - 6. Functional test and testing of electrical components shall be performed prior to subsystem testing and commissioning. Compartments and equipment shall be cleaned before commencement of functional testing. Functional testing shall include:

Visual and physical check of cables, busswork, circuit breakers, transformers, and connections associated with new and modified equipment.
 - 7. Complete ground testing of all grounding electrodes prior to operating the equipment utilizing a three-point ground test.
- B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated to the CONSTRUCTION MANAGER and after process control devices have been adjusted. The WORK of this Section includes adjusting limit switches and level switches prior to testing and setting pressure switches, flow switches, and timing relays.
- C. After initial settings have been completed, each subsystem shall be operated in the manual mode. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify proper start and stop sequence of pumps, proper operation of valves, proper speed control, and similar parameters.

- D. Subsystems, in the context discussed here, mean individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, and similar equipment.

3.2 COMMISSIONING

- A. Commissioning shall not be attempted until all subsystems have been found to operate satisfactorily; commissioning shall only be attempted as a function of normal plant operation in which plant process flows and levels are routine and equipment operates automatically in response to flow and level parameters or computer command, as applicable. Simulation of process parameters shall be considered only upon receipt of a written request by the CONTRACTOR.

** END OF SECTION **

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing the following:
1. Raceways, Fittings and Supports
 2. Concrete Pads, Underground Ducts, Manholes and Pull-Boxes
 3. Conductors, Wire and Cable
 4. Wiring Devices
 5. Disconnect Switches
 6. Electrical Identification
 7. Pushbuttons
 8. Cabinets and Enclosures
 9. Process Control Devices

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
1. Section 02200 Earthwork
 2. Section 03300 Cast-In-Place Structural Concrete
 3. Section 05500 Miscellaneous Metalwork
 4. Section 13300 Instrumentation and Control
 5. Section 15034 Gauges
 6. Section 16030 Electrical Tests

1.3 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
1. California Building Code
 2. National Electrical Code

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. Federal Specifications:

FS W-C-596E/GEN(1) Connector, Plug, Receptacle and Cable Outlet, Electrical Power

FS W-S-896E/GEN(1) Switches, Toggle (Toggle and Lode), Flush Mounted (ac)

FS WW-C-581E Conduit, Metal, Rigid, and Intermediate; And Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated

WW-C-581E Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated

2. Commercial Standards:

ANSI C80.1 Rigid Steel Conduit, Zinc Coated, Specification For

ANSI/IEEE 386 Separable Insulated Connector Systems for Power Distribution Systems Above 600V

ANSI C37.46 Specifications for Power Fuses and Fused Disconnecting Switches

NEMA TC2 Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)

NEMA ICS 6 Enclosures for Industrial Controls and Systems

NEMA 250 Enclosures for Electrical Equipment (1000 volts maximum)

NEMA WC7 Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy

ASTM B3 Soft or Annealed Copper Wire

ASTM B8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B33 Tinned Soft or Annealed Copper Wire for Electrical Purposes

ASTM B189	Lead Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
UL 44	Rubber-Insulated Wires and Cable
UL 83	Thermoplastic-Insulated Wires and Cable
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 50	Cabinets and Boxes

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. General

Shop drawings including the following:

Complete material list stating manufacturer and name of each item or class of material.
 Front, side, and rear elevations and top views.
 Location of conduit entrances and access plates.
 Identification of conductors not indicated on drawings.
 Identification numbers of conductors.
 Manufacturers' equipment drawings.
 Details of shielded power cable termination.
 Component data.
 Connection, terminal and internal wiring diagrams, and conductor sizes.
 Layout drawings indicating arrangement, dimensions and weights.
 Methods of anchoring.
 Finish.
 Nameplates.
 Temperature limitations, as applicable.

Manufacturer's product data including the following:

Catalogue cuts, bulletins, brochures, or photocopies of applicable pages for mass produced, non-custom manufactured products stamped to indicate the project name, applicable Specification section and paragraph, model number, ratings and options.

Lists of the following:

Materials, equipment, apparatus and fixtures proposed for use; with the list including sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

Test reports of the following:

Factory-fabricated products.
Currents resulting from DC high potential testing.

2. Lighting and Power Distribution Panelboards (N/A)

B. General Requirement

1. All equipment furnished by the contractor shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated (UL).
2. The construction and installation of all electrical equipment and materials shall comply with all applicable provisions of the Cal/OSHA Safety Orders (Title 8, CCR), State Building Standards, and Applicable local codes and regulations.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance procedures.

1.8 PROJECT RECORD DRAWINGS

A. The following shall be included in the PROJECT RECORD DRAWINGS:

1. Accurate location of conductors including depths and routing of concealed below-grade electrical WORK.
2. Accurate location of electrical WORK (raceway and conductors) where the location differs substantially from the locations indicated.

1.9 AREA DESIGNATIONS

A. **General:** For purposes of delineating electrical enclosure and installation requirements, certain areas are classified as defined below. Electrical installations within these areas shall conform to the indicated code requirements for the area indicated.

B. **General Purpose Locations: (E) MCC Room;** WORK installed in areas which are not otherwise specifically classified shall be "General Purpose." Enclosures shall comply with the requirements of these Specifications and shall be NEMA Type 1.

- C. **Damp Location: Air Compressor Area;** Locations which are indoors and 2 feet below grade elevation or which are indicated as damp locations on the Drawings shall have electrical installations which conform to the requirements for outdoor locations; except, that the air space from walls may be less than 1/4-inch and enclosures shall be NEMA Type 2. "Damp locations" shall include pipe galleries, tunnels, and basements. Rooms housing liquid handling equipment are also classified as damp locations regardless of grade elevation.
- D. **Outdoor and Corrosive Locations: Pump Gallery;** Unless noted otherwise in the drawings, locations shall have stainless steel threaded hardware; electrical hardware, fittings, and raceway systems shall be PVC-coated. Enclosures shall be NEMA Type 4X of fiberglass and reinforced polyester or 316 stainless steel.
- E. **Hazardous Locations:** NEC "Hazardous (Classified) Locations" shall be as indicated and shall comply with NFPA 820.

1.10 FACTORY TESTING

- A. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements and as follows:
 - 1. **Cabinets and Enclosures:** Each motor control center shall be completed, assembled, wired, and tested at the factory. All buses and wiring shall be given a dielectric test in accordance with the latest IEEE and NEMA Standards.
- B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.11 FIELD TESTING

- A. **Testing:** Products shall be field-tested for compliance with the indicated requirements.
- B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness field tests.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.
- B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements. Products shall not be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry.

- C. **Replacement:** Damaged materials or equipment, including face plates of panels and switchboard sections, shall be replaced or refinished by the manufacturer at no expense to the OWNER.

1.13 REGULATORY REQUIREMENTS

- A. In addition to other indicated regulatory requirements, the WORK of this Section shall comply with the requirements of SSPWC Subsection 209-1.

1.14 UTILITY REQUIREMENTS

- A. The WORK of this Section includes compliance with the requirements of San Diego Gas and Electric Company and payment of related charges.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Listing:** Electrical equipment and materials shall be listed for the intended purpose by an independent testing laboratory including Underwriters Laboratories (UL) or an independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.
- B. **Unlisted Products:** When a product is not available with a testing laboratory listing for the intended purpose, special testing (if any) required by the authority having jurisdiction shall be included in the original contract price.
- C. **Project/Site Conditions:** Unless otherwise indicated, equipment and materials shall be sized and rated for the ambient conditions in San Diego but not less than an ambient temperature of 40 degrees C at sea level without exceeding the manufacturer's stated tolerances.
- D. **Product Qualifications:** Equipment and materials shall be new and shall bear the UL label, where UL requirements apply. Equipment and materials shall be the products of reputable manufacturers specializing in the products indicated in this Section. Similar items in the project shall be products of the same manufacturer. Equipment and materials shall be of industrial grade and standard of construction and shall be of sturdy design and manufacture; and shall be capable of reliable, trouble-free service.

2.2 RACEWAY, FITTINGS AND SUPPORTS

- A. **Raceway:** Raceway shall comply with the following:
 - 1. **Rigid Steel Conduit:** N/A.
 - 2. **Intermediate Metal Conduit:** N/A.
 - 3. **Fittings:** Locknuts shall be extra heavy electrogalvanized steel for sizes through 2 inches. Locknuts larger than 2 inches shall be electrogalvanized malleable iron. Bushings shall be electrogalvanized malleable iron with

insulating collar. Grounding bushings shall be locking type and shall include a feed-through compression lug for securing the ground cables. Unions shall be electrogalvanized ferrous alloy type. Threadless fittings are not acceptable. Gaskets shall be made of neoprene.

Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction.

4. **Plastic Coated Rigid Steel Conduit and Fittings:** All indoor conduit, including in the ceilings shall be rigid steel conduit with PVC jacket and shall conform to Federal Specification WW-C-581E, ANSI C80.1, and to Underwriter's Laboratories specifications. The zinc surfaces of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit through the preparation and application processing. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 40 mils. A PVC jacketed coupling shall be provided with each length of conduit. A PVC sleeve equal to the OD of the conduit shall extend 1-1/2 inches from each end of coupling.

Fittings used with plastic coated conduit shall be similarly coated to the same thickness as the conduit and shall be provided with type 304 stainless steel hardware. Conduit and fittings shall be manufactured by the same company. Minimum size shall be 3/4 inch.

5. **Electrical Metallic Tubing:** N/A.
6. **Flexible Metal Conduit:** N/A.
7. **Liquidtight Flexible Steel Conduit:** N/A.
8. **Explosion proof Flexible Conduit:** Explosion proof flexible conduit shall be suitable for use in Class I, Division 1, Groups C and D hazardous areas complying with NEC and shall be watertight.
9. **Rigid Nonmetallic Conduit:** All buried conduit shall be rigid nonmetallic conduit NEMA TC2, EPC-80-PVC high impact, polyvinylchloride (PVC). Fittings used with PVC conduit shall be PVC solvent weld type. Nonmetallic conduits shall be UL listed for applications indicated. Minimum size shall be 2 inch.
10. **Wireways:** Wireways and auxiliary gutters shall be JIC EMP-1 sectional flanged oiltight type with hinged covers and shall be 8 inches by 8 inches in cross section unless otherwise indicated.
11. **Cable Trays:** N/A.

12. **Metallic Insulation Bushings:** Metallic insulated bushings shall have ground terminals and smooth and well-rounded surfaces to protect the conductor insulation. The conduit threads shall be deep, clean and easily attached to the conduits. The bushing shall be O-Z/Gedney, Thomas and Betts, or equal.

B. Boxes and Fittings: Boxes and fittings shall comply with the following:

1. **Sheet Metal Boxes:** Boxes and fittings installed in areas where electrical metallic tubing is indicated shall be standard UL approved electro-galvanized sheet steel.
2. **Cast Ferrous Alloy Boxes:** Boxes shall be hot-dip galvanized cast ferrous alloy unless otherwise indicated. Integrally cast threaded hubs or bosses shall be provided for conduit entrances and shall provide for full 5-thread contact on tightening. Drilling and threading shall be done before galvanizing. A full body neoprene gasket shall be included with the cover. Type 304 stainless steel screws shall be provided for covers. Where two or more devices are located together, outlet and device boxes shall be gang type. Cover plates shall be hot-dip galvanized cast ferrous alloy unless the particular device requires a cover that is not manufactured in this material.
3. **Floor Boxes:** Floor boxes shall be hot-dip galvanized cast boxes with an NEMA 4 rating. Boxes shall include a recessed ring neoprene gasket, hot-dip galvanized steel checker cover plates and type 304 stainless steel machine screws of not less than 1/4 inch diameter. The cover screws shall be flat head type or recessed socket head screws designed to be flush with cover plate.
4. **Welded Sheet Steel Boxes:** Large boxes shall be fabricated from welded steel and shall be hot-dip galvanized after fabrication. Before finish is applied, a grounding pad drilled for two bolted grounding lugs or a grounding stud shall be welded to the inside of the box. Hardware shall be 304 stainless steel. Boxes shall, as a minimum, meet NEMA 12 and JIC EMP-1 requirements.
5. **Explosion proof Boxes and Seal Fittings:** In areas specified as Class I, Division 1 or 2, hazardous, boxes and fittings shall be NEMA 7, Groups C and D, explosionproof. Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and UL listed for explosionproof sealing fittings.
6. **Hubs:** Threaded hubs for connection of conduit to junction, device or terminal boxes shall be made of cast ferrous alloy, electroplated with zinc and shall have insulated liner and insulating bushings. The hubs shall utilize a neoprene O-ring and shall ensure a watertight connection.

C. Raceway Supports: Raceway supports shall comply with the following:

1. **Conduit Supports:** 316 Stainless steel framing channel shall be used to support groups of conduit. Conduit supports for PVC coated rigid steel shall be one-hole PVC coated clamps or 316 stainless steel.
2. **Ceiling Hangers:** Ceiling hangers shall be adjustable galvanized carbon steel rod hangers. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise indicated hanger rods shall be 1/2-inch full-threaded rods and shall meet ASTM A193. Hanger rods in Damp or Outdoor Locations as defined per this Section, shall be shall be 316 stainless steel.
3. **Structural Attachments (Racks):** Structural attachments shall be constructed from 316 stainless steel channel as specified.

2.3 CONCRETE PADS, UNDERGROUND DUCTS, MANHOLES AND PULL-BOXES

- A. **General:** The WORK of this Section includes concrete pads, manholes, pull-boxes and concrete required for encasement, installation, or construction and shall be 2500-psi concrete conforming to the requirements of Section 03300 and the following:
 1. Consolidation of encasement concrete around duct banks shall be by hand puddling, and no mechanical vibration will be permitted.
 2. A workability admixture consisting of a hydroxylated carboxylic acid type in liquid form shall be used in encasement concrete, admixtures containing calcium chloride shall not be used.
 3. Concrete for encasement of conduit or duct banks shall contain an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.
- B. **Concrete Pads:** Concrete housekeeping pads shall be provided for floor-standing electrical equipment. Unless noted otherwise, housekeeping pads shall be 3 inches above surrounding finished floor or grade and shall be 2 inches larger in both dimensions than the supported equipment unless otherwise indicated.
- C. **Concrete-Encased Ducts:** Where an underground distribution system is indicated, it shall be constructed of multiple runs of single bore non-metallic ducts, concrete encased, with steel reinforcing bars, with underground manholes and pullboxes.
- D. **Manholes and Pull-Boxes** Manholes and pullboxes shall comply with the following:
 1. Manholes and pull-boxes shall be of precast concrete. Concrete construction shall be designed for traffic loading. Covers shall be parkway type, except as otherwise indicated. "P" covers shall be identified as "High Voltage Electric." "S" covers shall be identified as "Secondary Electric" and "C" covers as "Signal." Manholes and pullboxes shall be equipped with pulling-in irons opposite and below each ductway entrance. Manholes shall have concrete covers with 30-inch diameter lids. Covers and lids shall be bolted to cast-in-place steel frames with corrosion resistant hardware. Frames shall be factory-primed; covers shall be galvanized and shall have lifting handles.

2. Manholes and pullboxes shall have cable supports so that each cable is supported at 3-foot intervals within the manhole or pullbox. Cable supports shall be fastened with galvanized bolts and shall be fabricated of fiberglass or galvanized steel.
3. Duct entrances shall be grouted smooth. Ducts for primary and secondary cables shall be terminated with flush-end bells. Sections of prefabricated manholes and pullboxes shall be assembled with waterproof mastic. Each manhole or pullbox shall be set on a 6-inch bed of gravel as recommended by the manufacturer.

2.4 CONDUCTORS, WIRE AND CABLE

- A. **General:** The type, size and number of conductors shall comply with the indicated requirements. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided.

Conductors, including ground conductors, shall be copper. Insulation shall bear the manufacturer's trademark, type, voltage rating, and conductor size.

- B. **Color Coding:** Color coding shall comply with the following:

1. **Control Conductors:** Control conductors color coding shall be manufacturer's standard.
2. **Power Conductors:** Single-conductor power conductors shall have the following colors for 600V or less:

	<u>120/208V</u>	<u>480/277V</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Ground	Green	Green
Neutral	White	Grey

Color coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.

General purpose ac control conductors shall be pink. General purpose dc control conductors shall be blue.

Cables sized No. 4 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end. The cables shall be tagged at terminations and in pull boxes, handholes and manholes.

C. **Lighting and Receptacle Branch Circuit Conductors:** Lighting conductors shall be stranded except for No. 12 AWG which shall be solid.

1. Conductors shall comply with the following characteristics:

Voltage: 600 volts.

Conductor: Bare annealed copper; stranded in accordance with ASTM B8.

Insulation: THWN/THHN, 90 degree C dry, 75 degree C wet, polyvinylchloride (PVC) per UL 83.

Jacket: Nylon.

Flame resistance: UL 83.

D. **Power and Control Conductors and Cable, 600 Volts:** Conductors and cable shall comply with the following:

1. **Single Conductors:** Single conductor cable shall be stranded and shall be installed in conduits for power and control circuits.

Conductors shall comply with the following characteristics:

Voltage: 600 volts.

Conductor: Coated, Class B, stranded, annealed copper per ASTM B8.

Insulation: XHHW, 90 degrees C dry, 75 degrees C wet, composite of ethylene propylene rubber (EPR) and chlorosulfonated polyethylene (CSPE) per ICEA UL 44 and NEMA WC-7.

Jacket: Chlorosulfonated polyethylene (CSPE).

Flame resistance: IEEE 383.

2. **Multiconductor Cable:** N/A.

E. **Direct Burial:** N/A.

F. **Medium Voltage Power Conductors and Cable (5 KV-15 KV):** N/A

G. **Signal Cables:** Signal cables shall comply with the following:

1. **General:** Signal cable shall be provided for instrument signal transmission, alarm, communication and any circuit operating at less than 100 volts. Cables shall be color coded black and white for pairs or black, white and red for triads. Circuit shielding shall be provided in addition to cable shielding.

2. **Single Circuit:** Cable shall consist of one pair or triad, No. 16 AWG conductors with 15 mils of 90 degree C polyvinylchloride (PVC) insulation, 4 mils nylon conduit or jacket, twisted on a 2-inch lay, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 18 AWG 7-strand tinned copper drain wire and a 45 mil PVC jacket overall. Cable shall be UL listed, Type TC, rated 600 volts.
 3. **Multiple Circuit:** N/A
 4. **Thermocouple Extension:** N/A
 5. **Communication, Paging and Security System:** N/A
 6. **Modbus cable:** N/A
- H. **Portable Cord:** N/A
- I. **Splicing and Terminating Materials:** Splicing and terminating materials shall comply with the following:
1. **600 Volt Conductor and Cable Connectors:** Connectors shall be compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Connectors for wire sizes No. 10 AWG and smaller shall be nylon self-insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable.
In-line splices and taps shall be used only where indicated, or shown on the shop drawings. When used, they shall be of the same construction as other connectors. Splices shall be compression type, made with a compression tool die designed for the purpose. Splice shall be covered with a heat-shrinkable sleeve or boot.
 2. **5 KV and 15 KV Cable Terminators:** N/A
 3. **Portable Cable Fittings:** N/A

2.5 WIRING DEVICES

- A. **General:** Wiring devices shall be UL approved for the current and voltage indicated and shall comply with NEMA WD-1. Devices shall contain provisions for back wiring and side wiring with captively held binding screws.

Devices shall be brown, except those located in finished areas shall be ivory.

Special purpose devices shall be the color indicated.

Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively, and the indicated standards.

B. **Receptacles and Plugs:** N/A

C. **Switches:** Switches shall comply with the following:

1. **General Purpose (Indoor, Clean Areas):** General purpose switches shall be quiet AC type, specification grade, and shall comply with rated capacities as required. Switches shall match receptacles in color.
2. **Switches for Hazardous Areas:** Switches for control of lighting and small single-phase power loads in hazardous areas shall consist of a factory assembled and sealed combination general purpose type switch in an explosion-proof housing. The switch shall be rated in accordance with NEC for the area in which it is to be installed. The external operating mechanism shall consist of a wing-type handle having the "ON" and "OFF" positions visible from the front.
3. **Switches for Outdoor and Corrosive Areas:** Switches shall be heavy-duty industrial type 20-ampere pressswitch type with weatherproof/corrosion resistant neoprene plate. CONTRACTOR shall provide abuse-resistant nylon handles, and switches with corrosion-resistant steel nickel plate bridge.

D. **Device Plates:** Device plates shall be provided with switches. In noncorrosive indoor areas, receptacle device plates shall be made of sheet steel, zinc electroplated with chrome finish.

Device plates in corrosive or outdoor areas shall be corrosion-resistant/marine-duty type. Device plates for explosionproof equipment shall be factory provided with the equipment.

Device plates shall include engraved laminated phenolic nameplates with 1/8-inch white characters on black background.

Nameplates for switches shall identify panel and circuit number and area served.

Nameplates for receptacles shall identify circuit and voltage if other than 120 volts, single phase.

E. **Plug Strips:** N/A.

2.6 LIGHTING AND POWER DISTRIBUTION PANELBOARDS (N/A)

2.7 DISCONNECT SWITCHES

- A. Disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position. Switches shall have nameplates with manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600-volts. Heavy-duty switches shall be provided for all motor circuits

above 3 horsepower. In smaller motor circuits switches shall be general duty. Switch enclosure shall be NEMA 4X.

2.8 ELECTRICAL IDENTIFICATION

- A. **Nameplates:** Nameplates shall be fabricated from white-center, black-face laminated plastic engraving stock. Nameplates shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.
- B. **Conductor and Equipment Identification:** Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place.
- C. **Identification Tape (Buried):** Identification tape for protection of buried installation shall be a 6-inch wide green polyethylene tape imprinted "CAUTION - ELECTRIC UTILITIES BELOW".

2.9 PUSHBUTTONS

- A. Remote-mounted pushbuttons shall be NEMA rated heavy duty, oiltight type with synthetic rubber boots and any special gasketing required to make the completed station watertight. Provide NEMA Type 4 pushbutton for above ground indoor unit and NEMA Type 4X constructed of stainless steel or glass polyester for dry well area.
- B. Install provisions for locking pushbuttons in the OFF position wherever lockout provisions are indicated. Locking provision shall be 316 stainless steel.

2.10 CABINETS AND ENCLOSURES

- A. **General:** The WORK of this Section includes the following requirements for control compartments of motor control sections, for control cabinets of lighting panelboards, and for separate terminal and control cabinets:
 - 1. **Terminal Cabinets:** Terminal cabinets located indoors shall be NEMA 12. Cabinets located outdoors and in corrosive areas shall be NEMA 4X. Cabinets shall be provided with hinged doors. Cabinets shall be provided with channel mounted terminal blocks rated 30 amperes, 600 volt AC. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals. Sufficient terminal blocks to terminate 25 percent more conductors than are indicated shall be provided.
 - 2. **Components:** Compartments of motor control centers containing terminal blocks and control components shall be isolated from other compartments of the control center and shall have a separate hinged door with locking handle. Internal control components shall be mounted on a removable mounting pan.

3. **Relay and Control Cabinets:** Relay and control cabinets shall comply with NEMA 12 for enclosures. Floor-standing cabinets shall have locking handles with 3-point catches. Bottom conduit entrances shall be located accurately and cut to the conduit diameter using a circle cutter (not a torch). Interiors of relay and control compartments shall be finished white. Terminal block requirements shall comply with the requirements for Terminal Cabinets.

B. **Wiring:** Wiring of terminal cabinets and control cabinets shall be accomplished with stranded copper conductor rated for 600-volts and UL listed as Type MTW. Wires for annunciator and indication circuits shall be No. 16 AWG. Other wiring shall be No. 14 AWG. Color coding shall comply with the indicated requirements. Incoming wires to terminal or relay cabinets shall be terminated on a master set of terminal blocks. All wiring from the master terminals to internal components shall be factory-installed and shall be contained in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

C. **Engraving:** Nameplates shall comply with the indicated requirements.

2.11 ELECTROLIERS (NOT USED)

2.12 PROCESS CONTROL DEVICES (NOT USED)

2.13 MANUFACTURERS

A. Products of the type or model number indicated shall be manufactured by one of the below listed manufacturers (or equal):

1. Unions:
Appleton UNF or UNY
Crouse-Hinds UNF or UNY
2. Device Boxes:
Appleton FD
Crouse-Hinds FD
3. Sealing Compound:
Chico A
4. Watertight Seals:
O.Z. Gedney Co., Type CSMC
Thunderline Corp.
Link Seal
5. Lighting and Receptacle Branch Circuit Conductors:
Okoseal-N, Series 116-67-XXXX
6. Single Power and Control Conductors and Cable, 600V:
Okonite-Okolon, Series 112-11-XXXX

- Anaconda
Durasheath EP
7. Multiconductor Cables:
Okonite-Okolon, Series 202-11-3XXX
Anaconda
Durasheath EP
 8. Direct Burial Cables:
Okonite
CLX
 9. Medium Voltage Power Conductors and Cable (5-15 KV) Installed In Raceway: N/A
 10. Armored Cable:
Okoguard, Series 571-23-3XXX
Anaconda
Duralox Unishield EP
 11. Single Circuit Signal Cable:
Okoseal-N Type P-OS
 12. Multiple Circuit Signal Cable:
Okoseal-N Type SP-OS
 13. Thermocouple Extension:
Okonite P-OS, Type PLTC
 14. Portable Cords:
Okocord
 15. Compression Tool Die For Splicing:
Thomas and Betts Corp.
 16. Heat Shrinkable Moisture Seal Caps:
Raychem Corp. "Thermofit"
 17. 120V Receptacles (Indoor, Clean Areas):
Hubbell IG-5362
Arrow-Hart 6766
G.E. 4107-1 (Brown)
 18. 120V Receptacles (Outdoor, Process or Corrosive Areas):
Hubbell 53CM62/53CM21
General Electric GE5262-C
 19. 240V Duplex Receptacles (Gray):
Hubbell 5462
General Electric G.E. 4188-9

20. 240V Single Receptacles (Black):
Hubbell 9308
General Electric G.E. 4138-3
21. Three Phase Receptacles (60 amps):
Crouse-Hinds Catalog No. AREA 6424
Hubbell Hubbellock
22. Three Phase Receptacles (30 amps):
Crouse-Hinds Catalogue No. AREA 3423
Bryant Cat. 7223FR
Russell Stoll No. JRFA6344
23. Switches (Hazardous Areas):
Crouse-Hinds EFSC2129
Appleton EFSC175-F1
24. Electrical Identification:
Nameplates
Formica Type ES-1

Imprinted Plastic Coated Cloth
Brady
Thomas & Betts
25. Device Plates:
Crouse-Hinds
Appleton
26. Plug Strips:
Plugmold
27. Manholes and Pullboxes:
Brooks
Quikset
28. Flexible Conduit:
American Brass
Anaconda
Electroflex
29. Cable Trays:
P-W
Cope
30. Compression Connectors:
Burndt "Hi Lug"
Thomas & Betts "Shure Stake"
31. Spring Connectors (Wire Nuts):

- 3M "Scotch Lok"
Ideal "Wing Nuts"
32. Insulating Tape:
Scotch No. 33
Plymouth "Slip knot"
33. High Temperature Insulating Tape (Polyvinyl):
Plymouth
3M
34. Pre-Insulated Fork Tongue Lugs:
Thomas & Betts RC Series
Burndy
35. Epoxy Resin Splicing Kits:
3M Scotchcoat 82 Series
Burndy "Hy Seal"
36. Stress Cone Material For Make-up Of Medium Voltage Shielded Cable:
G & W
3M
duPont
37. Stainless Steel Covers:
Sierra S-line
Hubbell
38. Products For Cast Boxes:
Switches at outdoor locations
Crouse-Hinds DS 128
Mackworth Rees Style 3845
Joy Flexitite
- Switches at damp locations
Mackworth Rees Style 3496
Joy Flexitite
- Switches at dry locations
Crouse-Hinds DS 32G
Pyle National SCT-10k
- Receptacles at outdoor locations
Crouse-Hinds
Hubbell
- Receptacles at damp or dry locations
Crouse-Hinds DS 23G
Pyle National N-1
- Receptacles at corrosive locations

Crouse-Hinds "Ark Gard"
Appleton DTQ
Hubbell 52CM21 or 5221

39. Cast Boxes Required for Pull or Junction Boxes:
Floor boxes with checker plate covers
O-Z Type "YR",
Surface boxes
O-Z type "YH"
40. Floor Type Outlet Boxes:
Hubbell Catalog B-2530 with S-2530 cover plate
Steel City (Russell & Stoll) Catalog 78AL and 889
41. Power Outlet Boxes:
Hubbell Cat. No. SC-3098
Steel City Cat. No SFH40RG
42. Telephone Outlet Boxes:
Hubbell Cat. No. SS-309-T
Steel City Cat. No SFL10
43. Insulated Bushings:
O-Z Type A and B
Thomas & Betts
Steel City
Appleton
Efcor
Gedney
44. Insulated Grounding Bushings:
O-Z Type BL
Thomas & Betts
Steel City
Efcor
Gedney
45. Erickson Couplings:
Appleton Type EC
Thomas & Betts
Steel City
Efcor
Gedney
46. Liquid-tight Fittings:
Appleton Type ST
Thomas & Betts
Crouse-Hinds
Efcor
Gedney

- 47. Hubs:
Appleton Type HUB
Thomas & Betts
Myers Scrutite
Efcor
- 48. Sealing Fittings:
Appleton Type EYS
O-Z Type FSK
- 49. Expansion Couplings:
O-Z Type D
Crouse-Hinds Type

PART 3 -- EXECUTION

3.1 GENERAL

- A. **Field Control of Location and Arrangement:** The Drawings diagrammatically indicate the location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations shall be determined in the field based on the physical size and arrangement of equipment, finished elevations, and obstructions. Locations shown on the Drawings shall be adhered to as closely as possible. Omissions or conflicts on Drawings or between Drawings and Specifications shall be brought to the attention of the CONSTRUCTION MANAGER for clarification before proceeding with the WORK.
- B. **Installation:** The CONTRACTOR shall make all necessary provisions throughout the site to receive the work as construction progresses and shall furnish and install adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical fixtures, conduit, panelboard, and switches, and shall furnish and install sleeves through walls, floors, or foundations where electrical lines are required to penetrate.

Conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Fixtures, switches, convenience outlets, and similar items shall be located within finished rooms, as shown. Where the Drawings do not indicate exact locations, locations of concealed conductors shall be as indicated on the shop drawings.
- C. **Workmanship:** Materials and equipment shall be installed in accordance with printed recommendations of the manufacturer. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.
- D. **Tests:** The WORK of this Section includes tests required by the authority having jurisdiction. Tests shall be performed in the presence of the CONSTRUCTION MANAGER. The WORK includes testing equipment, replacement parts and labor

necessary to repair damage resulting from damaged equipment or from testing and correction of faulty installation. The following tests shall be performed:

Insulation resistance tests.
Operational testing of equipment.

- E. **Field Quality Control:** Conduit shall be provided with a number tag at each end and in each manhole and pullbox. Trays shall be identified by stencils at intervals not exceeding 50 feet, at intersections, and at each end.

3.2 RACEWAY, FITTINGS AND SUPPORTS

- A. **General:** Except as otherwise indicated, conduit installed in direct contact with earth and in concrete slabs on grade shall be corrosion-protected.

Conduit shall be left exposed until inspected by the CONSTRUCTION MANAGER.

Raceways shall be installed as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for the purpose intended. Factory elbows shall be used for all 3/4-inch conduits. Bends in larger sizes of metallic conduit shall be accomplished by field bending or by the use of factory elbows.

Non-metallic conduit may be run beneath structures or slabs on grade. In these instances conduit shall be placed at least 12 inches below the bottom of the structure or slab. Non-metallic conduit may be buried 24 inches minimum below grade, with a 3-inch concrete cover, in open areas or where otherwise not protected by concrete slab or structures. Top of concrete cover shall be colored red. Non-metallic conduit shall be permitted only in concealed locations as described above.

Where a run of concealed PVC conduit becomes exposed, a transition to rigid steel conduit is required. Such transition shall be accomplished by means of a factory elbow or a minimum 3-foot length of rigid steel conduit, either terminating at the exposed concrete surface with a flush coupling. Piercing of concrete walls by non-metallic runs shall be accomplished by means of a short steel nipple terminating with flush couplings.

Flexible conduit may be used in lengths required for the connection of recessed lighting fixtures; otherwise the maximum length of flexible conduit shall be 18 inches.

1. Application:

Embedded or encased in non-hazardous areas	Schedule 80 PVC
Exposed in corrosive areas	Plastic coated, rigid steel
Direct buried lighting and receptacle raceways in non-hazardous areas	Schedule 80 PVC

Hazardous and corrosive areas within stud walls, above suspended ceilings, and within elevator machine rooms	Plastic coated, rigid steel
Dry well/Pump room area	Plastic coated, rigid steel
Final raceway connections to lighting fixtures, equipment and pressure switches subject to vibration-DRY AREAS	Flexible non-metallic
Final raceway connections to Equipment	Liquidtight, flexible non-metallic

2. Conduit Runs Between Boxes: The number of directional changes of the conduit shall be limited to total not more than 270 degrees in any run between pull boxes. Conduit runs shall be limited to 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction. Bends and offsets shall be avoided where possible but, where necessary, shall be made without flattening or kinking, or shall be factory preformed bends. Turns shall be made with cast metal fittings or conduit bends. Welding, brazing or otherwise heating of conduit is not acceptable.
3. Junction and Pull Boxes: Cast junction or pull boxes shall be installed where required for pulling cable and as necessary to meet the indicated requirements. Pull boxes used for multiple conduit runs shall not combine circuits of different motor control centers, switchboards, or switchgear.
4. Conduit Terminations: The WORK of this Section includes conductors required to interconnect incoming annunciator, control and instrumentation except as otherwise indicated.

Two- and 3-conductor shielded cables installed in conduit runs which exceed 2,000 feet may be spliced in pullboxes. These cable runs shall have only one splice per conductor.

Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment. 120/208-volt and 480-volt branch circuit conductors may be spliced in suitable fittings at locations required. 5-kV conductors shall be spliced or terminated only at equipment terminals indicated.

Solid conductors shall be terminated at equipment terminal screws such that conductor is tightly wound around screw and does not protrude beyond screw head. Stranded conductors shall be terminated directly on equipment box lugs such that all conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.

Splices in 600-volt wire which are not pre-insulated shall be insulated with three layers of tape each half lapped except that splices in below grade pull boxes or in any box subject to flooding shall be made watertight using an epoxy resin splicing kit.

Splices to motor leads in motor terminal boxes shall be taped with varnished cambric tape and with high temperature tape on the exterior.

Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable manufacturer. The CONTRACTOR shall submit the proposed termination procedure as described for shop drawings.

Control devices, such as solenoid operated valves, that are normally supplied with conductor pigtails, shall be terminated as described for control conductors.

Conduit entering NEMA 1 type sheet steel boxes or cabinets shall be secured by locknuts on both the interior and exterior of the box or cabinet and shall have an insulating grounding or bonding bushing installed over the conduit end. Conduit entering other boxes shall be terminated with a threaded hub. Cast boxes and nonmetallic enclosures shall have threaded hubs. Joints shall be made with standard couplings or threaded unions. Metal parts of nonmetallic boxes and plastic coated boxes shall be bonded to the conduit system. Running threads shall not be used in lieu of conduit nipples, nor shall excessive thread be used on any conduit. The ends of conduit shall be cut square, reamed, and threaded with straight threads. Rigid steel conduit shall be made up tight and without thread compound. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O-ring. Joints shall be made with standard PVC couplings.

Conduit entering field equipment enclosures shall enter the bottom or side of the box. Where conduit comes from above, it shall be run down beside the enclosure and a tee conduit and drip leg installed.

5. Matching Existing Facilities: When new conduit is added to areas which are already painted, the conduit and its supports shall be painted to match the existing facilities. Where new conduit is used to replace existing conduit, the existing conduit and supports shall be removed, resulting blemishes shall be patched and repainted to match original conditions. Similarly, if existing conduits are to be reused and rerouted, resulting blemishes shall be corrected in the same manner.
6. Conduit Support: Exposed rigid steel or plastic coated conduit shall be run on supports spaced not more than 10 feet apart and shall be constructed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceiling. Exposed PVC conduit shall be run on supports

spaced not more than 3 feet apart for conduits up to 1 inch, 5 feet apart for conduits 1 1/4 inches to 2 inches and 6 feet apart for conduits 2 1/2 inches and larger. No conduit shall approach closer than 6 inches to any object operating above 30 degrees C. PVC conduit shall not be provided where it will be damaged by heat.

Conduit rack and tray supports shall be secured to concrete walls and ceilings by means of cast-in-place anchors. Individual conduit supports shall use cast-in-place anchors, die-cast, rustproof alloy or expansion shields. Wooden plugs, plastic inserts or gunpowder-driven inserts are not acceptable.

7. **Conduit Penetrations:** Unless otherwise indicated, conduit routed perpendicular through floors, walls or other concrete structures shall pass through cast-in-place openings wherever possible. In cases where cast-in-place openings are not possible, appropriate size holes shall be bored through the concrete to accommodate the conduit passage. The size and location of the holes shall not impair the structure's integrity. After completion, grout or caulk around conduit and finish to match existing surroundings. Unless otherwise protected, conduits that rise vertically through the floor shall be protected by a 3 1/2-inch high concrete pad with a sloping top.

Conduits entering manholes and handholes shall be horizontal. Conduits shall not enter through the concrete bottom of handholes and manholes. Wherever conduits penetrate outdoor concrete walls or ceilings below grade, watertight seal shall be installed.

8. **Conduit Separation:** Signal conduits shall be separated from AC power or control conduits. The separation shall be a minimum of 12 inches for metallic conduits and 24 inches for nonmetallic conduits.
9. **Conduit Seals For Hazardous or Corrosive Areas:** Conduit passing from a hazardous or corrosive area into a nonhazardous or noncorrosive area shall be provided with a sealing fitting which shall be located at the boundary in accordance with NEC.

Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and shall be UL listed for explosionproof sealing fittings. Sealing compound shall be nonhardening type for corrosive areas. Sealing compound shall not be poured in place until electrical installation has been otherwise accepted.

10. **Plastic Coated Conduit:** Plastic coated conduit shall be made up tight with strap wrenches. Conduit threads shall be covered by a plastic overlap which shall be coated and sealed in accordance with manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.

11. **Liquidtight Flexible Conduit:** The length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit. The length of liquidtight conduit shall not exceed 36 inches.
12. **Conduit Fittings:** Fittings shall comply with the same requirements as the raceway with which they will be used. Fittings having a volume less than 100 cubic inches for use with rigid steel conduit, shall be cast or malleable non-ferrous metal. Fittings larger than one inch shall be "mogul size." Fittings shall be of the gland ring compression type. Covers of fittings, unless in "dry" locations, shall include gaskets. Surface-mounted cast fittings, housing wiring devices in outdoor and damp locations, shall have mounting lugs.

Erickson couplings shall be used at all points of union between ends of rigid steel conduits which cannot be coupled. Running threads and threadless couplings shall not be used. Couplings shall be 3-piece type.

Transition fittings to mate steel to PVC conduit, and PVC access fitting, shall be as furnished or recommended by the manufacturer of the PVC conduit.

B. **Cable Tray:** N/A.

3.3 UNDERGROUND DUCTS, MANHOLES AND PULL-BOXES

A. **Underground Ducts:** Where an underground distribution system is indicated, installation shall comply with the following:

1. Ducts shall be laid on a grade line of at least 4 inches per 100 feet, sloping towards pullboxes or manholes. Duct shall be installed and pullbox and manhole depths adjusted so that the top of the concrete envelope is a minimum of 24 inches below grade. Changes in direction of the duct envelope by more than 10 degrees horizontally or vertically shall be accomplished using bends with a minimum radius 24 times the duct diameter. Couplings shall be staggered at least 6 inches vertically. Bottom of trench shall be of select backfill or sand. Horizontal and vertical duct separation shall be maintained by plastic spacers set every 5 feet. The duct array shall be anchored every 4 feet to prevent movement during placement of the concrete envelope. Each bore of the completed duct bank shall be cleaned by drawing through it a standard flexible mandrel one foot long and 1/4-inch smaller than the nominal size of the duct through which the mandrel will be drawn. After passing of the mandrel, a wire brush and swab shall be drawn through. A raceway, in the duct envelope, which does not require conductors, shall have a 1/8-inch polypropylene pull cord installed throughout the entire length of the raceway.
2. Duct bank markers shall be installed every 200 feet along run of duct bank, at changes in horizontal direction of duct bank, and at ends of duct bank. Concrete markers, 6 by 6 inches square and one foot long, shall be set flush with grade. The letter "D" and arrow set in the concrete shall be facing in the direction of the duct alignment

- B. **Manholes and Pull-Boxes:** Manholes and handholes shall be set plumb to limit the depth of standing water to a maximum of 2 inches. Manhole covers, unless otherwise indicated, shall be set at grade. Sections of pre-fabricated manholes and pullboxes shall be assembled with waterproof mastic and shall be set on a 6-inch bed of gravel as recommended by the manufacturer.

3.4 CONDUCTORS, WIRE AND CABLE

- A. **General:** Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the cable insulation. The cable pulling compound shall be polymer-based and UL approved. It shall be non-toxic, non-flammable, non-corrosive and compatible with all cable types. The product shall dry to a thin semi-liquid film that will not clog the conduit. The cable pulling lubricant shall be AquaGel II by Ideal Industries, or equal. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed.

Whenever a cable leaves a raceway, a cable support shall be provided.

When flat bus bar connections are made with unplated bar, the contact areas shall be "scratch-brushed" before connection. Bolts shall be torqued to the bus manufacturer's recommendations.

- B. **600 Volt Conductor and Cable:** Conductors in panels and electrical equipment, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Lacing is not necessary in plastic panel wiring duct. Conductors crossing hinges shall be bundled into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.

Slack shall be provided in junction and pull boxes, handholes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box. Amount of slack shall be equal to largest dimension of the box. Where plastic panel wiring duct is installed for wire runs, lacing is not required. Plastic panel wiring duct shall not be used in manholes and handholes.

Stranded conductors shall be terminated. Conductors shall be terminated directly on the terminal block. Compression lugs and connectors shall be installed using manufacturer's recommended tools.

Lighting and receptacle circuits may be in the same conduit in accordance with derating requirements of the NEC. However, lighting and receptacle circuits shall not be installed in conduits with power or control conductors.

Solid wire shall not be lugged nor shall electrical spring connectors be used on any except for solid wires in lighting and receptacle circuits. Lugs and connectors shall be installed with a compression tool.

Terminations at 460 volt motors shall be made by bolt-connecting the lugged connectors. Connections shall be insulated and sealed with factory-engineered kits.

Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends. Bolt connection area shall be kept free of mastics and fillers to facilitate rapid stripping and re-entry. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations.

In-line splices and tees shall be made with tubular compression connectors and insulated as for motor terminations, except that conductors No. 10 AWG and smaller may be spliced using self-insulating connectors. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin splicing kits. Terminations at devices with 120V pigtail leads, at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors.

Conductor and cable markers shall be provided at splice points.

- C. **Signal Cable:** Circuits shall be installed as individually shielded twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required. Terminal blocks shall be provided at instrument cable junctions, and circuits shall be identified at such junctions unless otherwise indicated. Signal circuits shall be installed without splices between instruments, terminal boxes, or panels.

Shields are not acceptable as a signal path, except for circuits operating at radio frequencies and utilizing coaxial cables.

Common ground return conductors for two or more circuits are not acceptable.

Unless otherwise indicated, shields shall be bonded to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Terminals shall be installed for running signal leads and shield drain wires through junction boxes.

Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes. Shield drain wires for spare circuits shall not be grounded at either end of the cable run.

Terminal boxes shall be installed at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

Cable for paging, telephone, and security systems shall be installed and terminated in compliance with the manufacturer's recommendations.

- D. **600 Volt Conductor and Cable:** Cable shall comply with the following requirements:

1. **Terminations:** Terminations shall be in exact conformance with the written instructions accompanying the splicing or terminator kits. Special care shall be exercised to ensure that cable insulation is not damaged during stripping

back of jacket, semiconductor layers, shields; or penciling operations. All stripping, back operations involving the cutting of nonmetallic layers of the cable shall be accomplished using a ringing tool. The usage of pocket or jack knives for stripping back or penciling operations is prohibited.

2. Installation: Cable installation shall comply with the following:

Cable Placement: Cable shall be carefully checked as to condition, size, and length before being pulled into raceways. Cable pulled into the incorrect raceway or cut too short to rack, train, or splice shall be removed and replaced.

Cable In Manholes: Cable shall be supported at all times during handling, without short bends or excessive sags, and shall not be permitted to lie on the manhole floor. Cable ends shall be sealed. Cable racks or trays shall be installed for permanent support. Temporary support required during placement shall be with rope slings or timbers.

Supports: Cable supports and securing devices shall have bearing surfaces oriented parallel to the surfaces of the cable sheath and shall be installed to provide adequate support without deformation of the cable jackets or insulation. Adequate cable end lengths shall be provided and properly placed in electrical equipment or manholes to avoid longitudinal strains and distorting pressures on the cable at termination points and duct end bells. Final inspection shall be made after all cable is in place. Where supports, bushings, and end bells deform the cable jacket, additional supports shall be installed.

Cable Racks: Cable racks shall be installed according to the drawings and as required to provide the proper cable support. Cable racks shall be installed on spacings of not greater than 36 inches and shall be bolted to permanent wall surfaces with anchors or continuous slot concrete inserts.

3. Cable Pulling: Cable pulling shall comply with the following:

Pulling Lines: Raceway cleaning mandrels and cable pulling shall be done with manila hemp line to prevent damage to the raceway. Nylon or stranded steel pulling lines shall not be used. "Fishing" may be done with CO₂-propelled polyethylene cord.

Cable Grips: Factory-installed pulling eyes shall be used for pulling cable where they are available. Where pulling eyes are not available, woven wire cable grips shall be used to pull all single-conductor cable. When a cable grip or pulling eye is used for pulling, the area of the cable covered by the grip or seal, plus 6 inches, shall be cut off and discarded when the pull is completed. As soon as the cable is pulled into place, the pulling eyes on cable grips shall be removed and the cable shall be resealed.

Swivels: A reliable, nonfreezing type of swivel, or swivel connection, shall be inserted between the pulling rope and the cable pulling eye, grip, or loop to prevent twisting under strain.

Reel Inspection: Before unreeling, the outside of each cable reel shall be carefully inspected and protruding nails, fastenings, or other objects which might damage the cable shall be removed. A thorough visual inspection for flaws, breaks, or abrasions in the cable sheath shall be made as the cable leaves the reel, and the pulling speed shall be slow enough to permit this inspection. Damage to the sheath or finish of the cable shall be sufficient cause for rejecting the cable. Cable damaged in any way during installation shall be replaced.

Feeding Tubes: A flexible feeding tube, with a removable nozzle sized to fit the raceway shall be used in pulling all cable. The feeding tube shall be long enough to extend from the raceway entrance to the outside of the manhole and shall be arranged such that it will be impossible for the cable to drag across the edge of the manhole ring or any other damaging surface. Cable pulling into, through, or out of new manholes shall be done with the entire concrete manhole lid removed.

Lubricant: A cable lubricant shall be used on conductors in all pulls, and shall be of the type, and applied in the quantity, recommended by the cable manufacturer. Only lubricants recommended by the cable manufacturer shall be used.

Pulling Tension: The pulling tension of the cable shall not exceed the maximum tension recommended by the cable manufacturer. Pulling mechanisms of both manual and power types shall have the rated capacity (in pounds) clearly marked on the mechanism. A dynamometer shall be used to show the tension on the cable during all pulls and the indicator shall be constantly watched. If any excessive strain develops, the pulling operation shall be stopped at once and the difficulty determined and corrected. Under no circumstances shall cable be pulled using equipment not monitored by a dynamometer. The use of motor vehicles in pulling cable is prohibited. Any cable so pulled shall be removed and replaced. The dynamometer shall have a maximum tension indicator to show the maximum tension developed during a pull. The cable play-out reel shall be equipped with a suitable brake and shall be constantly manned during all pulls.

Sidewall Pressure: To avoid insulation damage from excessive sidewall pressure at bends in raceway runs, the pulling tension in pounds exiting a bend shall not exceed 200 times the radius of the bend in feet.

Cable Bends: Extreme care shall be exercised during the placement of all cable to prevent tension and bending conditions in excess of the manufacturer's recommendations. The permanent radius of bend after cable installation shall be in accordance with the cable manufacturer's recommendations.

4. **Moisture Seals:** Cable shall be kept sealed except when termination and splicing work is being performed. The ends of all cables shall be sealed with heat-shrinkable caps. Cap sizes shall be as recommended by the cap manufacturer for the cable outside diameter and insulation. Caps shall contain sufficient adhesive that shrinkage of the cap during application results in formation of a positive, watertight seal. Before and after pulling, the leading end seal of each length of cable shall be examined and replaced if necessary. All cut cable ends shall be promptly sealed after cutting except those to be spliced or terminated immediately.
5. **Splices:** Power cable circuits may be spliced only at locations indicated. Splices shall not be made to utilize short lengths of cable, nor shall they be made to provide correct lengths on cable initially cut too short for a particular circuit.
6. **Terminations:** Cable shall be trained into place without bending the cable in a radius less than the manufacturer's recommended minimum bending radius. If the cable is bent at any time to a radius less than the minimum bending radius, the cable shall be terminated at a point at least 6 inches below the bend. Where the shape and configuration of terminal fittings make workmanlike insulation of the bare connection impractical, the contours of the connection shall be smoothed by filling voids and molding over irregular surfaces with a moldable filler material as recommended by the terminator kit manufacturer before application of the recommended thickness of insulating material.

E. **Portable Cord:** N/A

F. **Testing:** Testing shall comply with the requirements of Section 16030 and the following:

1. **Signal Cable:** Each signal pair or triad shall be tested for electrical continuity. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory without further test. For pairs with greater than 50 ohm loop resistance, the expected loop resistance shall be calculated considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad. Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500 volt megohmmeter shall be used for insulation resistance measurements.

2. **5-15 KV Cable:** N/A

3.5 WIRING DEVICES

- A. **General:** Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

Unless otherwise indicated, receptacles and switches installed in sheet steel boxes shall be flush mounted and shall be located 18 inches above the floor unless otherwise indicated.

Switch boxes and receptacles installed in cast device boxes shall be mounted 48 inches above the floor.

- B. **Application of Boxes and Covers:** Boxes and covers shall be installed as follows:

1. Outlet, switch, and junction boxes for flush-mounting in general purpose locations shall be sheet metal.
2. Outlet, switch, and junction boxes where surface mounted in exposed locations shall be cast alloy ferrous boxes with mounting lugs, zinc or cadmium plating, and enamel finish. Surface mounted boxes in concealed locations may be welded sheet steel boxes.
3. Outlet, control station, and junction boxes, including covers, for installation in corrosive locations shall be fiberglass-reinforced polyester and shall include mounting lugs.
4. Sheet metal boxes for flush-mounting in concrete shall include with cast, malleable box covers and gaskets. Covers for pressed steel boxes shall be one-piece pressed steel, cadmium plated, except that boxes for installation in plastered areas shall be stainless steel over plaster rings.
5. Outlet boxes shall be used as junction boxes wherever possible. Where separate pullboxes are indicated, they shall include screw covers. Outdoor boxes shall be galvanized and shall be provided with gasketed covers and threaded hubs. Indoor boxes shall be painted.

3.6 LIGHTING AND POWER DISTRIBUTION PANELBOARDS (N/A)

3.7 CABINETS AND ENCLOSURES

- A. The installation of cabinets and enclosures shall comply with the following:
1. **Cabinets:** Cabinets shall be set plumb at an elevation such that the maximum circuit breaker height shall be less than 5 ft 6 inches. Top edge of trim of adjacent panels shall be at the same height. Panels which are indicated as flush mounted shall be set so cabinet is flush and serves as a "ground" for plaster application.
 2. **Connections:** Factory bus and wire connections shall be made at shipping splits, and all field wiring and grounding connections shall be made after the assemblies are anchored.

3. Finishes: Enclosures smaller in volume than 500 cubic inches shall be finished in accordance with the manufacturer's standard procedures. Finish color shall be No. 61 complying with ANSI Z55.1.

3.8 EQUIPMENT ANCHORING

- A. Freestanding or wall-hung equipment shall be anchored in place by methods that will meet seismic requirement in the area where project is located. Wall-mounted panels that weigh more than 500 pounds or which are within 18 inches of the floor shall be provided with fabricated steel support pedestal(s). Pedestals shall be of welded steel angle sections. If the supported equipment is a panel or cabinet and enclosed with removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds, shall have auxiliary floor supports.
- B. Anchoring methods and leveling shall comply with the printed recommendations of the equipment manufacturers.

3.9 CONDUCTOR AND EQUIPMENT IDENTIFICATION

- A. The completed electrical installation shall include adequate identification to facilitate proper control of circuits and equipment and to reduce maintenance effort.
- B. Control and instrumentation wire and cable shall be assigned a unique identification number. Numbers shall be assigned to conductors having common terminals. Identification numbers shall appear within 3 inches of conductor terminals. "Control" shall be defined as any conductor used for alarm, annunciator, or signal purposes or any connect switch or relay contacts or any relay coils.
 1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number will form a part of the individual wire number. All individual control conductors and instrumentation cable shall be identified at pull points as described above.
 2. The instrumentation cable numbers shall incorporate the loop numbers shown.
 3. Refer to Section 13300 for numbering details.
- C. Spare conductors shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
- D. Nameplates shall be provided for panelboards, panels, starters, switches, and pushbutton stations. In addition to the name plates indicated, control devices shall be equipped with standard collar-type legend plates, as required.
- E. Terminal strips shall be identified by imprinted, varnished, marker strips attached under the terminal strip.

- F. Three-phase receptacles shall be consistent with respect to phase connection of receptacle terminals. Errors in phasing shall be corrected at the bus, not at the receptacle.
- G. Toggle switches which control loads out of sight of switch, and all multi-switch locations of more than 2 switches, shall have suitable inscribed finish plates.
- H. Empty conduits shall be tagged at both ends to indicate the destination at the far end. Where it is not possible to tag the conduit, destination shall be identified by marking an adjacent surface.
- I. Identification tape shall be installed directly above buried raceway. Tape shall be installed 8 inches below grade and parallel with raceway. Identification tape shall be installed for buried raceway not under buildings or equipment pads except identification tape is not required for protection of street lighting raceway.

** END OF SECTION **

SECTION 16400 - LOW VOLTAGE ELECTRICAL SERVICE AND DISTRIBUTION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing all electrical service sections, distribution switchboards, special control panels, control and terminal cabinets, control devices, circuit breakers, and all appurtenant work, complete and operable.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 16030 Electrical Tests
 - 2. Section 16050 Basic Electrical Materials and Methods
 - 3. Section 16480 Motor Control

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. National Electrical Code (NEC) NFPA 70

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. ANSI/IEEE C37.20 Switchgear Assemblies, including Metal-Enclosed Bus
 - 2. ANSI/NEMA ICS-2 Devices, Controllers, and Assemblies for Industrial Control
 - 3. ANSI/UL 1008 Automatic Transfer Switches, Safety Standard for
 - 4. NEMA PB2 Dead Front Distribution Switchboard

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. Shop drawings of the service section and switchboards. After review of shop drawings of the service section by the CONSTRUCTION MANAGER, said drawings shall also be submitted to the utility company for approval prior to fabrication.
 - 2. Design test reports conducted for similar assemblies at the factory.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL.

1. Operating procedures.
2. Maintenance procedures.
3. Manufacturer's parts list, illustrations, assemblies and diagrams.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Materials:** All materials and equipment furnished under this Specification shall be new and shall bear the Underwriters' Laboratories label where such service is regularly available.
- B. **Equipment:** All equipment for the same purpose shall be of the same make.
- C. **Enclosure Requirements:** All outdoor equipment, fixtures, and wiring devices shall be of weatherproof construction.
- D. **Standard Products:** Materials and equipment shall be catalogue products of companies regularly engaged in the manufacture of such items, shall be the latest standard design that conforms to the specification requirements, and shall essentially duplicate material and equipment that has been in satisfactory use for several years.

2.2 SWITCHBOARDS (N/A)

2.3 MAIN SERVICE SWITCHBOARD (N/A)

2.4 SWITCHBOARD INSTRUMENTS (N/A)

2.5 TRANSFORMERS

- A. All indoor transformers shall be dry-type and shall conform to or exceed the requirements of the latest applicable IEEE, NEMA, and ANSI standards. Transformers rated 3 kva and below shall be designed not to exceed 80-degree C temperature rise; 5 kva and greater shall be designed not to exceed 115-degree C temperature rise.
- B. **Isolation Transformers:** Isolation transformers shall be designed to lessen effects of transient generation into the supply power and shall act as a buffer for SCR current surges. Transformers shall have full capacity taps, four 2.5 percent taps, two above and two below primary windings. Transformers shall have a 150 degree C insulation and shall be UL listed.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit breakers having a frame size of 150-amperes or less shall be molded-case type with thermal magnetic non-interchangeable, trip-free, sealed trip units. Breaker contact material shall be a non-weldable silver alloy. Breakers shall have arc-extinguishing chutes.

2.7 MOTOR STARTERS

- A. Motor magnetic starter units shall be NEMA size I or larger shall have a thermal-magnetic trip

unit. Contactor circuit shall include 3- phase thermal overload protection, ambient compensated. Overload trip units shall be furnished to suit the nameplate full load current of the equipment installed. IEC rated starters are not acceptable. Magnetic starters shall have auxiliary contacts as required by electrical motor control diagrams including one spare N.O. and one N.C. contacts.

2.8 MANUFACTURERS

A. Products of the type indicated shall be manufactured by the following (or equal):

1. Transformers and Starters

General Electric
Westinghouse
Square D

PART 3 -- EXECUTION

3.1 INSTALLATION - GENERAL

- A. All electrical equipment materials shall be installed securely in place. Equipment shall be mounted parallel and perpendicular to the walls, floors, and ceilings.
- B. All anchors and fasteners shall be types designed for the intended purpose and shall be capable of adequately, safely, and permanently securing the material in place. Screws shall be used on wood surfaces, masonry anchors in concrete or brick, toggle bolts on hollow walls, machine screws, bolts, or welded studs on steel. Nails shall be used only for temporary attachment or support.
- C. Omissions or conflicts on Drawings or between Drawings and Specifications shall be brought to the attention of the CONSTRUCTION MANAGER for clarification before proceeding with the work.
- D. The CONTRACTOR shall make all necessary provisions throughout the site to receive all equipment as construction progresses and shall provide adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical cabinets, enclosures, conduit, panelboards, and switches, and shall provide sleeves through walls, floors, or foundations where electrical lines are required to penetrate.
- E. Floor standing equipment shall be leveled with shims as required to maintain horizontal surfaces within 1/32-inch per horizontal foot; after leveling, equipment shall be anchored, then grouted so that no space is existing between concrete and equipment support beams.

3.2 PREPARATION AND FINISH

- A. All equipment cabinets or enclosures furnished under this Section shall have a finish which conforms to Section 16480.

3.3 TESTING

- A. All WORK shall be tested per Section 16030.

** END OF SECTION **

SECTION 16480 - MOTOR CONTROL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing group-mounted and unit motor control as required for motors provided.
- B. If motors furnished are different from those indicated, then starters, overload elements, and branch circuit protection shall be adjusted and coordinated as required to control and protect the motors provided.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 16030 Electrical Tests
 - 2. Section 16050 Basic Electrical Materials and Methods
 - 3. Section 16400 Low Voltage Electrical Service and Distribution

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. National Electrical Code (NEC) NFPA 70

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. NEMA ICS-1 General Standards for Industrial Controls
 - 2. NEMA ICS-2 Industrial Control Devices, Controllers, and Assemblies
 - 3. UL 845, 489, 508 Electric Motor Control Centers, Molded Case Circuit Breakers, and Industrial Control Equipment

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:
 - 1. Shop drawings of all motor control centers and components.
 - a. Shop drawing submittals shall comply with the "Shop Drawings and Samples" paragraph of Section 16050. The submittal shall also include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per

phase and ground; electrical characteristics including voltage, frame size and trip ratings of overcurrent devices, short circuit withstand ratings, and protective device time-current curves of all equipment and components.

2. Product data on motor starters and combination motor starters, relays, pilot devices and switching and overcurrent protective devices.
3. A wiring diagram and an elementary control diagram for each motor control center cubicle. An identifying number shall be assigned to each wire.
4. Seismic design certification and anchorage sketches in accordance with Section 16050.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Spare parts data listing.
2. Source and current prices of replacement parts.
3. Recommended maintenance procedures and intervals.
4. Factory test reports.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Motor control centers shall be stored in a clean, dry space. Maintain factory wrapping or provide an additional heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Motor control centers shall be handled carefully to avoid damage to motor control center components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All similar products of the same type shall be furnished by a single manufacturer.
- B. Motor control assemblies (motor control centers) shall conform to the standards for NEMA Class II, type B assemblies.
- C. Components and assemblies shall comply with NEMA ICS 2.

2.2 DESIGN, CONSTRUCTION AND MATERIAL REQUIREMENTS (N/A)

2.3 MOTOR STARTERS -- GROUP MOUNTED (N/A)

2.4 MAIN AND FEEDER CIRCUIT BREAKERS

- A. Circuit breakers having a frame size of 150 amperes or less shall be molded-case type with thermal magnetic non-interchangeable, trip-free, sealed trip units. Breaker contact material shall be a non-weldable silver alloy. Breakers shall have arc-extinguishing chutes.

2.5 PREPARATION AND FINISH

- A. The CONTRACTOR shall have the manufacturer of the motor control center enclosures prepare them in strict accordance with the following requirements:
 - 1. NEMA 1 gasketed indoor assemblies shall be prepared and finished using materials and methods of the manufacturer's standard finish and colors, except that at least 2 coats of the final finish shall be applied by the manufacturer.

2.6 CONTROL DEVICES (N/A)

2.7 FACTORY TESTS

- A. The motor control centers and components shall be given manufacturer's standard electrical and mechanical production tests and inspections with complete test reports submitted to the CONSTRUCTION MANAGER for approval. The tests shall include, but not be limited to, electrical continuity check, dielectric tests for each circuit and inspection for proper functioning of all components, including controls, protective devices, metering and alarm devices.
- B. Motor control centers shall be tested in accordance with NEMA ICS-2.

2.8 NAMEPLATES, TOOLS AND SPARE PARTS

- A. **Spare Parts:** The WORK includes the following spare parts:
 - 1. 1 unit control transformer for each size of magnetic starter
 - 2. 3 bezels of each color installed in pilot indicators
 - 3. 1 dozen panel lamps
 - 4. 1 dozen control fuses of each size provided in the WORK

Spare parts shall be stored in tool boxes and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

2.9 MANUFACTURERS

- A. Products of the type indicated shall be manufactured by one of the following (or equal):
 - 1. Motor Control Centers
General Electric

PART 3 - EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall install the motor control center in accordance with manufacturer's published instructions. Conduit installation shall be coordinated with manufacturer's as-built drawings so that all conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section which contains the devices to which conductors are terminated.

3.2 INSTALLATION

- A. The motor control center shall be set level within 1/32-inch per horizontal foot. After leveling and shimming, the CONTRACTOR shall anchor motor control center to concrete pad and shall grout in place so that no space exists between the pad and support beams.
- B. The CONTRACTOR shall:
 - 1. Torque all bus bar bolts to manufacturer's recommendations; tighten all sheet metal and structure assembly bolts.
 - 2. Adjust all MCP devices to lowest setting consistent with reliable operation under normal conditions. Verify that overload devices are proper for equipment installed; make necessary changes in overload devices as required for motors having power factor correcting capacitors.
 - 3. After equipment is installed, touch up scratches and verify that nameplate and other identification is accurate and in compliance with these Specifications.
- C. The CONTRACTOR shall install pushbutton stations that are remote from the motor control centers, as shown on the drawings.

3.3 FIELD TESTING

- A. The CONTRACTOR shall test all pilot lamp indicators and test all controls prior to plant startup.
- B. The CONTRACTOR shall perform all the testing required by Section 16030.

** END OF SECTION **

SECTION 16485 - LOCAL CONTROL PANELS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing local control panels including enclosures, wiring and control devices.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 13300 Instrumentation and Control
2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

- A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. JIC EGP-1 Electrical Standards for General Purpose Machine Tools
2. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
3. UL Underwriters' Laboratories

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted:

1. Manufacturer's product data including catalogue cut sheets showing classifications.
2. Arrangement drawings of the local control panel enclosure indicating the front door and rear panel equipment arrangement and dimensions.
3. List of materials and components.
4. Connection diagrams.
5. Shop drawings indicating mounting of devices, discrete inputs and outputs, and termination points.

1.6 OWNER'S MANUAL

- A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance procedures.
3. Manufacturer's certification that products comply with the indicated requirements.

1.7 FACTORY TESTING

- A. **Product Testing:** Panels shall be tested at the factory for sequence of operation.
- B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.8 FIELD TESTING

- A. **Testing:** Panels shall be field-tested for functional operation after connection of external conductors and prior to equipment startup.

PART 2 -- PRODUCTS

2.1 LABELING

- A. Products shall bear the UL label.

2.2 CLASSIFICATION

- A. Unless otherwise indicated, enclosures installed indoors shall be NEMA 12 with gasketed doors. Enclosures installed outdoors or in corrosive areas shall be NEMA 4X. Enclosures installed in the indicated hazardous areas shall comply with the NEC requirements for that area.

2.3 SIZE

- A. Unless otherwise indicated, the minimum enclosure area, height by width, shall be twice the sum of the areas of the individual components mounted on the back panel. The enclosure depth shall not be less than 6 inches.

2.4 LOCAL CONTROL PANELS (LCP)

- A. The LCP shall be designed to provide the indicated sequence of operations. The LCP controls shall be 120 VAC. Control conductors shall comply with the requirements of Section 16050.
- B. Each LCP shall include terminal strips identified for the connection of external conductors. The LCP shall include sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with shop drawings. The LCP shall be the source of power for 120 VAC solenoid valves interconnected with the LCP. Equipment associated with the LCP shall be ready for service after connection of conductors to equipment, controls, and LCP.
- C. Internal wiring shall be factory-installed and shall be enclosed in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and shall be anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent contact.
- D. The main feeder disconnect shall be flange-mounted unless otherwise indicated.
- E. Each source of voltage and motor control shall include a means for disconnecting by disconnecting or pull-apart terminal blocks or a disconnect operable from the panel front.

- F. Motor starters: Motor starters, where indicated, shall comply with Section 16400. Each motor starter shall include contact closures for motor overload local indication and remote alarm.
- G. Discrete outputs from the LCP shall be provided by electrically isolated dry contacts rated for 5 amps at 120 VAC. Analog inputs and outputs shall be isolated 4-20 mA two-wire signal with power supply complying with Section 13300.
- H. Identification of panel-mounted devices, conductors, and electrical components shall comply with Section 13300.
- I. LCPs shall include programmable logic controllers (PLCs) in accordance with Section 13300.
- J. Indicating lights shall be "Push-to-Test" type.

2.5 COLOR CODING

- A. Wiring shall be color coded complying with Section 16050.

2.6 LABELING AND NAMEPLATES

- A. **Labeling:** Local control panel components shall be labeled to match the description on the elementary diagram. Internal components of the local control panel on the back side of the door shall be labeled with the same description as provided on the front side. Labeling shall be permanently marked on or near each component. Plastic embossed labels such as "Dymo" tape will not be accepted.
- B. **Nameplates:** External door-mounted components and the local control panel description shall be identified with plastic nameplates.

2.7 GROUNDING

- A. Neutrals of locally derived control circuits shall be grounded to the mounting plate using a copper bus or grounding lug. A grounding lug for a size No. 2 AWG bare copper conductor shall be included to ground the panel to the plant's grounding system.

2.8 MANUFACTURERS

- A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

Hoffmann Engineering Co., Bulletin A
E.M. Wiegman and Co., Inc.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Products, equipment, conduit, conductors and terminations shall be installed in accordance with the manufacturer's written installation instructions and Section 16050.
- B. LCP interior and exteriors shall be cleaned and coatings shall be touched up to match original finish upon completion of the WORK.

- C. Alternating current control circuits shall be grounded. One terminal of each load device shall be connected to the grounded conductor. Control contracts shall be installed in the ungrounded side of the circuit.
- D. Signal and control wiring shall be separated and installed in separate wireways.
- E. The panel shall be grounded to the plant grounding system as indicated.
- F. Local control panel centers shall be mounted at 36 inches minimum above the finished floor.
- G. A copy of the wiring diagrams shall be placed on the inner panel door. Drawings shall be enclosed in a transparent, protective jacket. A metal pocket measuring not less than 10 inches wide by 8 inches high by 3/4-inch deep shall be provided on the inside of the door for the drawings.

** END OF SECTION **

SUPPLEMENTARY SPECIAL PROVISIONS

APPENDICES

APPENDIX A
NOTICE OF EXEMPTION

NOTICE OF EXEMPTION

(Check one or both)

TO: X RECORDER/COUNTY CLERK
P.O. BOX 1750, MS A-33
1600 PACIFIC HWY, ROOM 260
SAN DIEGO, CA 92101-2422

FROM: CITY OF SAN DIEGO
PLANNING DEPARTMENT
1222 FIRST AVENUE, MS 413
SAN DIEGO, CA 92101

OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET, ROOM 121
SACRAMENTO, CA 95814

PROJECT NO.: WBS #B-14167.02.06

Project Title: South Bay Water Reclamation Plant Sludge Pump

PROJECT LOCATION-SPECIFIC: The South Bay Water Reclamation Plant (SBWRP) is located at 2411 Dairy Mart Road. The project site is within Council District 8 and the Tijuana River Valley Planning Area.

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: The project would replace the existing air driven pumps with new electric-powered positive displacement sludge pumps and grinders. All work occurs below ground-level and within the existing Headworks building at the southern end of the SBWRP. No grading or new ground disturbance is proposed or required.

NAME OF PUBLIC AGENCY APPROVING PROJECT: City of San Diego

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: City of San Diego, Public Works Dept./Brian Vitelle
525 B Street, Suite 500 (MS 908A)
San Diego, CA 92101
619-533-7413

EXEMPT STATUS: (CHECK ONE)

- () MINISTERIAL (SEC. 21080(b)(1); 15268);
() DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a));
() EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c))
(X) CATEGORICAL EXEMPTION: 15301(b) (Existing Facilities)
() STATUTORY EXEMPTION:

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an environmental review which determined that this project meets the criteria set forth in CEQA Section 15301(b) (Existing Facilities), which allows for minor repair or alteration of existing facilities of both investor and publicly owned utilities used to provide electric power, natural gas, sewerage, or other public utilities services. The project involves no or negligible expansion of use and the exceptions listed in CEQA Guidelines Section 15300.2 would not apply.

LEAD AGENCY CONTACT PERSON: REBECCA MALONE

TELEPHONE: 619-446-5371

IF FILED BY APPLICANT:

- 1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?
() YES () NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA

Signature of Myra S. Human

SENIOR PLANNER

01/16/2015

SIGNATURE/TITLE

DATE

CHECK ONE:

(X) SIGNED BY LEAD AGENCY

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR:

APPENDIX B
FIRE HYDRANT METER PROGRAM

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER DI 55.27	DEPARTMENT Water Department
SUBJECT FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)	PAGE 1 OF 10	EFFECTIVE DATE October 15, 2002
	SUPERSEDES DI 55.27	DATED April 21, 2000

1. **PURPOSE**

- 1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

- 2.1 All authorities and references shall be current versions and revisions.
- 2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15
- 2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986
- 2.4 California Code of Regulations, Titles 17 and 22
- 2.5 California State Penal Code, Section 498B.0
- 2.6 State of California Water Code, Section 110, 500-6, and 520-23
- 2.7 Water Department Director

Reference

- 2.8 State of California Guidance Manual for Cross Connection Programs
- 2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention
- 2.10 American Water Works Association Standards for Water Meters
- 2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

- 3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

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3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.

3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. **POLICY**

4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.

4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.

4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:

a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.

b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:

1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.

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2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.
3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).
4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).
5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).
6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.
7. All private fire hydrant meters shall have backflow devices attached when installed.
8. The customer must maintain and repair their own private meters and private backflows.
9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.
10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

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11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.
 12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.
 13. The outlet shall have a 2 ½ “National Standards Tested (NST) fire hydrant male coupling.
 14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).
- 4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.
- 4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.
- 4.6 **Conditions and Processes for Issuance of a Fire Hydrant Meter**
- Process for Issuance
- a. Fire hydrant meters shall only be used for the following purposes:
 1. Temporary irrigation purposes not to exceed one year.

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2. Construction and maintenance related activities (see Tab 2).
 - b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.
 - c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.
 - d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.
 - e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.
 - f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.
 - g. After the fees have been paid and an account has been created, the

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meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

4.7 Relocation of Existing Fire Hydrant Meters

- a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as "Hotline"), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter's relocation.
- b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.
- c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

4.8 Disconnection of Fire Hydrant Meter

- a. After ten (10) months a "Notice of Discontinuation of Service" (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.
- b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

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for removal of the meter.

- c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.
- d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.
- e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. **EXCEPTIONS**

- 5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. **MOBILE METER**

- 6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

- a) **Vehicle Mounted Meters:** Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

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inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters:** Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

- 1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.
- 2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

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7. **FEE AND DEPOSIT SCHEDULES**

- 7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. These deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. **UNAUTHORIZED USE OF WATER FROM A HYDRANT**

- 8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.
- 8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.
- 8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.
- 8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER DI 55.27	DEPARTMENT Water Department
SUBJECT FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)	PAGE 10 OF 10	EFFECTIVE DATE October 15, 2002
	SUPERSEDES DI 55.27	DATED April 21, 2000

- 8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

**Larry Gardner
Water Department Director**

- Tabs: 1. Fire Hydrant Meter Application
 2. Construction & Maintenance Related Activities With No Return To Sewer
 3. Notice of Discontinuation of Service

APPENDIX

Administering Division: Customer Support Division

Subject Index: Construction Meters
 Fire Hydrant
 Fire Hydrant Meter Program
 Meters, Floating or Vehicle Mounted
 Mobile Meter
 Program, Fire Hydrant Meter

Distribution: DI Manual Holders



Application for Fire Hydrant Meter (EXHIBIT A)

(For Office Use Only)

NS REQ	FACH
DATE	BY

METER SHOP (619) 527-7449

Meter Information

Application Date	Requested Install Date:
------------------	-------------------------

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) Zip:	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, if so, explain:		
Estimated Duration of Meter Use:		Check Box If Reclaimed Water

Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ()
*Business license#		*Contractor license#	
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: <small>(PERSON IN ACCOUNTS PAYABLE)</small>			Phone: ()
Site Contact Name and Title:			Phone: ()
Responsible Party Name:			Title:
Cal ID#			Phone: ()
Signature:		Date:	
Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter			

Fire Hydrant Meter Removal Request	Requested Removal Date:
Provide Current Meter Location if Different from Above:	
Signature:	Title: Date:
Phone: ()	Pager: ()

City Meter	Private Meter
Contract Acct #:	Deposit Amount: \$ 936.00 Fees Amount: \$ 62.00
Meter Serial #	Meter Size: 05 Meter Make and Style: 6-7
Backflow #	Backflow Size: Backflow Make and Style:
Name:	Signature: Date:

WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER

Auto Detailing
Backfilling
Combination Cleaners (Vactors)
Compaction
Concrete Cutters
Construction Trailers
Cross Connection Testing
Dust Control
Flushing Water Mains
Hydro Blasting
Hydro Seeing
Irrigation (for establishing irrigation only; not continuing irrigation)
Mixing Concrete
Mobile Car Washing
Special Events
Street Sweeping
Water Tanks
Water Trucks
Window Washing

Note:

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party
Company Name and Address
Account Number: _____

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter # _____, located at (*Meter Location Address*) ends in 60 days and will be removed on or after (*Date Authorization Expires*). Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego
Water Department
Attention: Meter Services
2797 Caminito Chollas
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619) _____ - _____.

Sincerely,

Water Department

APPENDIX C

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

Materials Typically Accepted by Certificate of Compliance

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX D
SAMPLE CITY INVOICE

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123		Contractor's Name:	
Project Name:		Contractor's Address:	
Work Order No or Job Order No.			
City Purchase Order No.		Contractor's Phone #:	Invoice No.
Resident Engineer (RE):		Contractor's fax #:	Invoice Date:
RE Phone#:	Fax#:	Contact Name:	Billing Period: (to

Item #	Item Description	Contract Authorization			Previous Totals To Date		This Estimate		Totals to Date		
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					\$ -		\$ -		\$ -	0.00%	\$ -
2					\$ -		\$ -		\$ -	0.00%	\$ -
3					\$ -		\$ -		\$ -	0.00%	\$ -
4					\$ -		\$ -		\$ -	0.00%	\$ -
5					\$ -		\$ -		\$ -	0.00%	\$ -
6					\$ -		\$ -		\$ -	0.00%	\$ -
7					\$ -		\$ -		\$ -	0.00%	\$ -
8					\$ -		\$ -		\$ -	0.00%	\$ -
9					\$ -		\$ -		\$ -	0.00%	\$ -
10					\$ -		\$ -		\$ -	0.00%	\$ -
11					\$ -		\$ -		\$ -	0.00%	\$ -
12					\$ -		\$ -		\$ -	0.00%	\$ -
13					\$ -		\$ -		\$ -	0.00%	\$ -
14					\$ -		\$ -		\$ -	0.00%	\$ -
15					\$ -		\$ -		\$ -	0.00%	\$ -
16					\$ -		\$ -		\$ -	0.00%	\$ -
17	Field Orders				\$ -		\$ -		\$ -	0.00%	\$ -
18					\$ -		\$ -		\$ -	0.00%	\$ -
	CHANGE ORDER No.				\$ -		\$ -		\$ -	0.00%	\$ -
					\$ -		\$ -		\$ -	0.00%	\$ -
Total Authorized Amount (including approved Change Order)					\$ -		\$ -		\$ -	Total Billed	\$ -

SUMMARY

A. Original Contract Amount	\$ -
B. Approved Change Order #00 Thru #00	\$ -
C. Total Authorized Amount (A+B)	\$ -
D. Total Billed to Date	\$ -
E. Less Total Retention (5% of D)	\$ -
F. Less Total Previous Payments	\$ -
G. Payment Due Less Retention	\$0.00
H. Remaining Authorized Amount	\$0.00

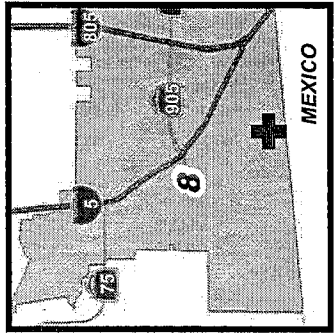
<p>I certify that the materials have been received by me in the quality and quantity specified</p> <hr/> <p>Resident Engineer</p> <hr/> <p>Construction Engineer</p>

Retention and/or Escrow Payment Schedule

Total Retention Required as of this billing (Item E)	\$0.00
Previous Retention Withheld in PO or in Escrow	\$0.00
Add'l Amt to Withhold in PO/Transfer in Escrow:	\$0.00
Amt to Release to Contractor from PO/Escrow:	

Contractor Signature and Date: _____

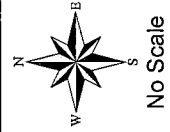
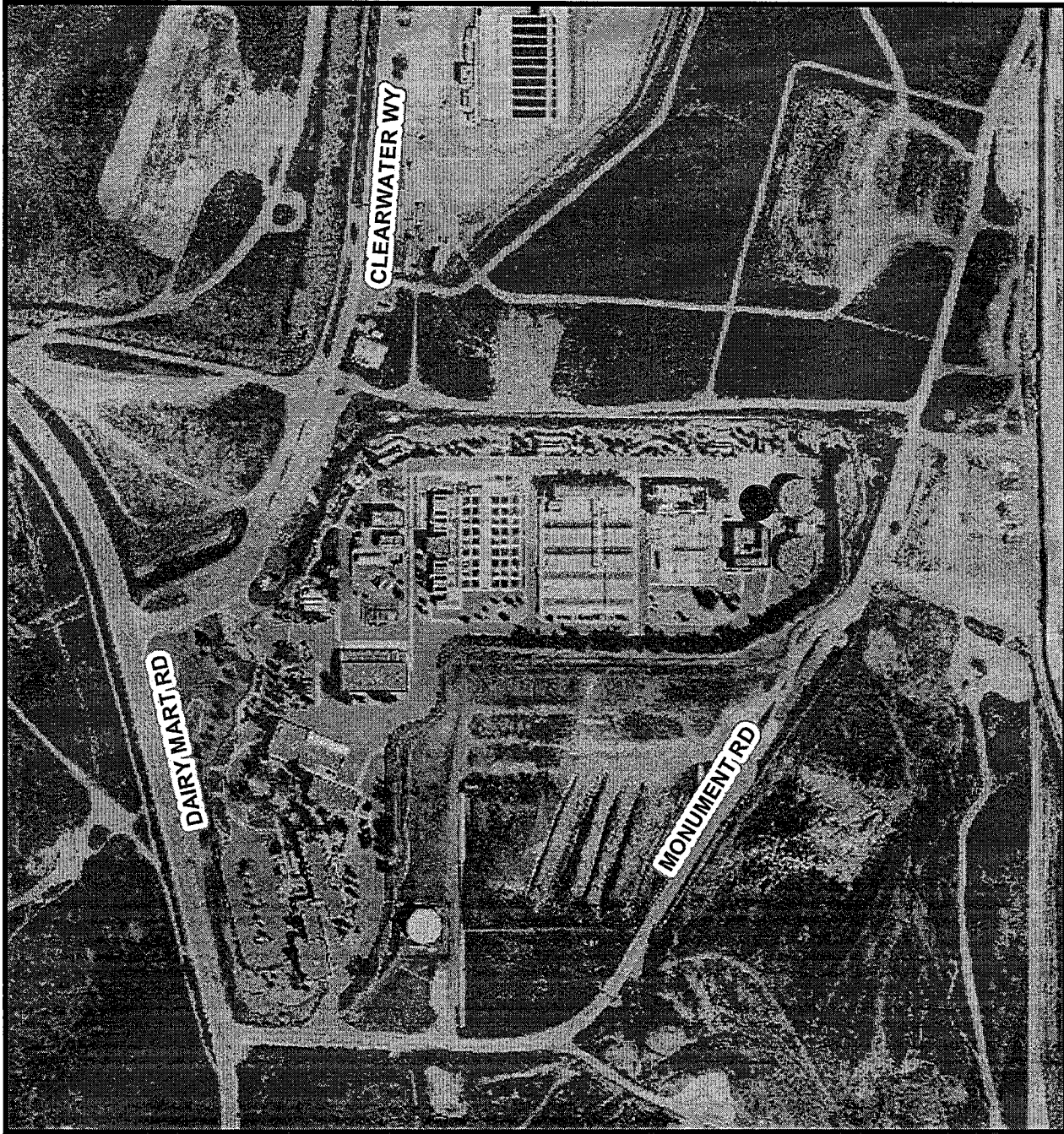
APPENDIX E
LOCATION MAP



SBWRP SLUDGE PUMP & GRINDER INSTALLATION

SENIOR ENGINEER
Iraj Asgharzadeh
619-533-5105
PROJECT ENGINEER
Delfa Fakhizadeh
619-533-4646

PROJECT MANAGER
Brian Vitelle
619-533-7413



Legend

● Project Location

COMMUNITY NAME: Tijuana River Valley

COUNCIL DISTRICT: 08

SAP ID: B-14167

Date: May 28, 2015



e-Bidding SBWRP Sludge Pump & Grinder Installation - Appendix E - Location Map (Rev. July 2013)

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ATTACHMENT F
INTENTIONALLY LEFT BLANK

CERTIFICATIONS AND FORMS

Instruction to Bidders, Section 1 - The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this bid are true and correct.

Bidder's General Information

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that 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, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that 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, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

**NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND
SUBMITTED WITH BID UNDER 23 UNITED STATES CODE 112 AND
PUBLIC CONTRACT CODE 7106**

State of California

County of San Diego

The bidder, being first duly sworn, deposes and says that he or she is authorized by the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that 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, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that 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, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 7-13.3, "Drug-Free Workplace", of the project specifications, and that;

This company has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 7-13.2, "American With Disabilities Act", of the project specifications, and that;

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 7-13.4, ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than \$50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

AFFIDAVIT OF DISPOSAL

(To be submitted upon completion of Construction pursuant to the contracts Certificate of completion)

WHEREAS, on the _____ DAY OF _____, 2_____ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

SBWRP Sludge Pump & Grinder Installation

(Name of Project)

as particularly described in said contract and identified Bid No. **L-16-1374-DBB-2**, SAP No. (WBS/IO/CC) **B-14167**, and WHEREAS, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and WHEREAS, said contract has been completed and all surplus materials disposed of:

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, _____.

_____ Contractor
by

ATTEST:

State of _____ County of _____

On this _____ DAY OF _____, 2____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared _____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

BID ITEMS

*** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY ***
TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY
SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION

Item No.	Quantity	Unit	NAICS	Payment Reference	Description	Unit Price	Extension
BASE BID							
1	1	LS	237110	9-3.1	General Construction	 	\$
2	1	LS	237110	9-3.1	Final Approval of Operation & Maintenance Manual (or Owner's Manuals) and Master Record Documents(Stipulates Lump Sum)	 	\$
3	1	LS	524126	2-4.1	Bonds (Payment and Performance)	 	\$
4	1	LS	237110	9-3.4.1	Mobilization	 	\$
5	1	AL		9-3.5	Field Orders - Type II	 	\$40,000.00
6	1	LS	541330	701-13.9.5	Water Pollution Control Program Development	 	\$
7	1	LS	237990	701-13.9.5	Water Pollution Control Program Implementation	 	\$
ESTIMATED TOTAL BASE BID:							\$

LIST OF SUBCONTRACTORS

***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY ***
TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY
SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION**

In accordance with the requirements of the "Subletting and Subcontracting Fair Practices Act", Section 4100, of the California Public Contract Code (PCC), the Bidder is to list below the name, address and license number of each Subcontractor who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement, in an amount of or in excess of 0.5% of the Contractor's total Bid. Failure to comply with this requirement may result in the Bid being rejected as non-responsive. The Contractor is to list only one Subcontractor for each portion of the Work. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percentage of the Work to be performed with the Bidder's own forces. The Bidder is to also list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which the Bidders are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB	WHERE CERTIFIED ②	CHECK IF JOINT VENTURE PARTNERSHIP
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____							
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____							

① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Subcontractor is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

NAMED EQUIPMENT/MATERIAL SUPPLIER LIST
***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY *****
TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY
SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION

NAME, ADDRESS AND TELEPHONE NUMBER OF VENDOR/SUPPLIER	MATERIALS OR SUPPLIES	DOLLAR VALUE OF MATERIAL OR SUPPLIES (MUST BE FILLED OUT)	SUPPLIER (Yes/No)	MANUFACTURER (Yes/No)	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB	WHERE CERTIFIED
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____						
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____						

① As appropriate, Bidder shall identify Vendor/Supplier as one of the following and shall include a valid proof of certification (except for OBE,SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Vendor/Supplier is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

ELECTRONICALLY SUBMITTED FORMS

THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF FORMAT WITH BID SUBMISSION

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

- A. BID BOND – See Instructions to Bidders, Bidders
Guarantee of Good Faith (Bid Security) for further
instructions**
- B. CONTRACTOR’S CERTIFICATION OF PENDING
ACTIONS**
- C. EQUAL BENEFITS ORDINANCE - CERTIFICATION
OF COMPLIANCE**

**Bids will not be accepted until ALL forms are submitted
as part of the bid submittal**

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

- The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

- The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

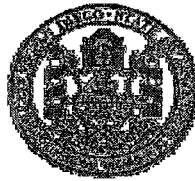
Contractor Name: _____

Certified By _____ Title _____
Name

_____ Date _____
Signature

USE ADDITIONAL FORMS AS NECESSARY

**EQUAL BENEFITS ORDINANCE
CERTIFICATION OF COMPLIANCE**



For additional information, contact:
CITY OF SAN DIEGO
EQUAL BENEFITS PROGRAM
202 C Street, MS 9A, San Diego, CA 92101
Phone (619) 533-3948 Fax (619) 533-3220

COMPANY INFORMATION	
Company Name:	Contact Name:
Company Address:	Contact Phone:
	Contact Email:

CONTRACT INFORMATION	
Contract Title:	Start Date:
Contract Number (if no number, state location):	End Date:

SUMMARY OF EQUAL BENEFITS ORDINANCE REQUIREMENTS

The Equal Benefits Ordinance [EBO] requires the City to enter into contracts only with contractors who certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the contract. To comply:

- Contractor shall offer equal benefits to employees with spouses and employees with domestic partners.
 - Benefits include health, dental, vision insurance; pension/401(k) plans; bereavement, family, parental leave; discounts, child care; travel/relocation expenses; employee assistance programs; credit union membership; or any other benefit.
 - Any benefit not offer an employee with a spouse, is not required to be offered to an employee with a domestic partner.
- Contractor shall post notice of firm’s equal benefits policy in the workplace and notify employees at time of hire and during open enrollment periods.
- Contractor shall allow City access to records, when requested, to confirm compliance with EBO requirements.
- Contractor shall submit *EBO Certification of Compliance*, signed under penalty of perjury, prior to award of contract.

NOTE: This summary is provided for convenience. Full text of the EBO and Rules Implementing the EBO are available at www.sandiego.gov/administration.

CONTRACTOR EQUAL BENEFITS ORDINANCE CERTIFICATION

Please indicate your firm’s compliance status with the EBO. The City may request supporting documentation.

- I affirm **compliance** with the EBO because my firm (*contractor must select one reason*):
- Provides equal benefits to spouses and domestic partners.
 - Provides no benefits to spouses or domestic partners.
 - Has no employees.
 - Has collective bargaining agreement(s) in place prior to January 1, 2011, that has not been renewed or expired.
- I request the City’s approval to pay affected employees a cash equivalent in lieu of equal benefits and verify my firm made a reasonable effort but is not able to provide equal benefits upon contract award. I agree to notify employees of the availability of a cash equivalent for benefits available to spouses but not domestic partners and to continue to make every reasonable effort to extend all available benefits to domestic partners.

It is unlawful for any contractor to knowingly submit any false information to the City regarding equal benefits or cash equivalent associated with the execution, award, amendment, or administration of any contract. [San Diego Municipal Code §22.4307(a)]

Under penalty of perjury under laws of the State of California, I certify the above information is true and correct. I further certify that my firm understands the requirements of the Equal Benefits Ordinance and will provide and maintain equal benefits for the duration of the contract or pay a cash equivalent if authorized by the City.

Name/Title of Signatory	Signature	Date

FOR OFFICIAL CITY USE ONLY

Receipt Date:	EBO Analyst:	<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved – Reason:
---------------	--------------	-----------------------------------	-------------------------------------------------

(Rev 02/15/2011)

City of San Diego

CITY CONTACT: Lisa Nguyen - Contract Specialist, Email: LTNguyen@sandiego.gov
Phone No. (619) 533-3435, Fax No. (619) 533-3633

ADDENDUM "A"

 **e - Bidding** FOR



SBWRP Sludge Pump & Grinder Installation

BID NO.: _____ L-16-1374-DBB-2
SAP NO. (WBS/IO/CC): _____ B-14167
CLIENT DEPARTMENT: _____ 2000
COUNCIL DISTRICT: _____ 8
PROJECT TYPE: _____ BO

BID DUE DATE:

**1:30 PM
NOVEMBER 12, 2015
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101**

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. ATTACHMENTS:

To Section 5, CERTIFICATION AND FORMS, page 303, Bid Items, **DELETE** in its entirety and **SUBSTITUTE** with page 3 of this Addendum.

James Nagelvoort, Director
Public Works Department

Dated: *October 21, 2015*
San Diego, California

JN/HM/Lad

BID ITEMS

*** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY ***
 TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY
 SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION

Item No.	Quantity	Unit	NAICS	Payment Reference	Description	Unit Price	Extension	
BASE BID								
1	1	LS	237110	9-3.1	General Construction		\$	
2	1	LS	237110	9-3.1	Final Approval of Operation & Maintenance Manual (or Owner's Manuals) and Master Record Documents(Stipulates Lump Sum)		\$	
3	1	LS	524126	2-4.1	Bonds (Payment and Performance)		\$	
4	1	LS	237110	9-3.4.1	Mobilization		\$	
5	1	AL		9-3.5	Field Orders - Type II		\$40,000.00	
6	1	LS	541330	701-13.9.5	Water Pollution Control Program Development		\$	
7	1	LS	237990	701-13.9.5	Water Pollution Control Program Implementation		\$	
TOTAL BASE BID:								\$

City of San Diego

CITY CONTACT: Lisa Nguyen - Contract Specialist, Email: LTNguyen@sandiego.gov
Phone No. (619) 533-3435, Fax No. (619) 533-3633

ADDENDUM "B"

 **e - Bidding** FOR



SBWRP Sludge Pump & Grinder Installation

BID NO.: _____ L-16-1374-DBB-2
SAP NO. (WBS/IO/CC): _____ B-14167
CLIENT DEPARTMENT: _____ 2000
COUNCIL DISTRICT: _____ 8
PROJECT TYPE: _____ BO

BID DUE DATE:

1:30 PM
NOVEMBER 12, 2015
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

_____ Seal:
For City Engineer Date

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. BIDDER'S QUESTIONS

Q1. Can you tell me where to find Volume III Documents?

A1. The FTP site link to the Moyno Pump and Grinder O&M Manual can be found on page 39, Section 2-15, TECHNICAL STUDIES AND DATA.

Q2. Also, is there a list of material the City is providing.

A2. See PRE-PUCHASED EQUIPMENT GENERAL NOTES on sheet 2 of the Contract Drawings.

Q3. I don't see in the specs where the city is providing the sludge pumps, grinders, and control panels, but I see in the PID drawings a comment the City is providing these items. I'd like to know if City purchase includes testing, including vibration and torsional analysis.

A3. Section 11000 – Equipment General Provisions, 1.5.A.9, 1.5.A.10, and 1.12 do not apply to the City supplied sludge pumps and grinders, however they may be applicable to the air compressors.

James Nagelvoort, Director
Public Works Department

Dated: *October 27, 2015*
San Diego, California

JN/HM/egz

**EQUAL BENEFITS ORDINANCE
CERTIFICATION OF COMPLIANCE**



For additional information, contact:
CITY OF SAN DIEGO
EQUAL BENEFITS PROGRAM
 202 C Street, MS 9A, San Diego, CA 92101
 Phone (619) 533-3948 Fax (619) 533-3220

COMPANY INFORMATION

Company Name: Tharsons Inc Contact Name: Michael Lopez
 Company Address: 7039 University Ave, #210 Contact Phone: 619-464-1261
La Mesa, CA 91942 Contact Email: tharsonsconstruction@gmail.com

CONTRACT INFORMATION

Contract Title: SBWRP Sludge Pump & Grinder Installation Start Date:
 Contract Number (if no number, state location): 2-16-1374-PBB-2 End Date:

SUMMARY OF EQUAL BENEFITS ORDINANCE REQUIREMENTS

The Equal Benefits Ordinance [EBO] requires the City to enter into contracts only with contractors who certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the contract. To comply:

- Contractor shall offer equal benefits to employees with spouses and employees with domestic partners.
 - Benefits include health, dental, vision insurance; pension/401(k) plans; bereavement, family, parental leave; discounts, child care; travel/relocation expenses; employee assistance programs; credit union membership; or any other benefit.
 - Any benefit not offer an employee with a spouse, is not required to be offered to an employee with a domestic partner.
- Contractor shall post notice of firm's equal benefits policy in the workplace and notify employees at time of hire and during open enrollment periods.
- Contractor shall allow City access to records, when requested, to confirm compliance with EBO requirements.
- Contractor shall submit *EBO Certification of Compliance*, signed under penalty of perjury, prior to award of contract.

NOTE: This summary is provided for convenience. Full text of the EBO and Rules Implementing the EBO are available at www.sandiego.gov/administration.

CONTRACTOR EQUAL BENEFITS ORDINANCE CERTIFICATION

Please indicate your firm's compliance status with the EBO. The City may request supporting documentation.

- I affirm **compliance** with the EBO because my firm (*contractor must select one reason*):
- Provides equal benefits to spouses and domestic partners.
 - Provides no benefits to spouses or domestic partners.
 - Has no employees.
 - Has collective bargaining agreement(s) in place prior to January 1, 2011, that has not been renewed or expired.

- I request the City's approval to pay affected employees a cash equivalent in lieu of equal benefits and verify my firm made a reasonable effort but is not able to provide equal benefits upon contract award. I agree to notify employees of the availability of a cash equivalent for benefits available to spouses but not domestic partners and to continue to make every reasonable effort to extend all available benefits to domestic partners.

It is unlawful for any contractor to knowingly submit any false information to the City regarding equal benefits or cash equivalent associated with the execution, award, amendment, or administration of any contract. [San Diego Municipal Code §22.4307(a)]

Under penalty of perjury under laws of the State of California, I certify the above information is true and correct. I further certify that my firm understands the requirements of the Equal Benefits Ordinance and will provide and maintain equal benefits for the duration of the contract or pay a cash equivalent if authorized by the City.

Michael Lopez / President

[Signature]

11/10/2015

Name/Title of Signatory

Signature

Date

FOR OFFICIAL CITY USE ONLY

Receipt Date: EBO Analyst: Approved Not Approved – Reason:

(Rev 02/15/2011)

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.



The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.



The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: Tharsos Inc

Certified By Michael Lopez Title President

[Signature] Name
Signature Date 11/10/2015

USE ADDITIONAL FORMS AS NECESSARY

BID BOND

**See Instructions to Bidders, Bidder Guarantee of Good Faith
(Bid Security)**

KNOW ALL MEN BY THESE PRESENTS,

That THARSOS INC. as Principal, and
RLI INSURANCE COMPANY as Surety, are held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled

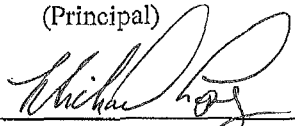
SBWRP SLUDGE PUMP & GRINDER INSTALLATION, BID NUMBER L-16-1374-DBB-2

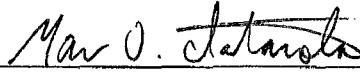
NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this 6TH day of NOVEMBER, 2015

THARSOS INC. (SEAL)
(Principal)

RLI INSURANCE COMPANY (SEAL)
(Surety)

By: 
(Signature)
MICHAEL LOPEZ, PRESIDENT

By: 
(Signature)
MARK D. IATAROLA, ATTORNEY-IN-FACT

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

CIVIL CODE § 1189

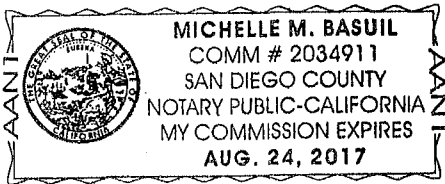
A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of SAN DIEGO)
On 11/6/2015 before me, MICHELLE M. BASUIL, NOTARY PUBLIC,
Date Here Insert Name and Title of the Officer
personally appeared MARK D. IATAROLA
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/~~she~~/they executed the same in his/~~her~~/their authorized capacity(ies), and that by his/~~her~~/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.



Signature Michelle M. Basuil
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____ Document Date: _____
Number of Pages: _____ Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: MARK D. IATAROLA
 Corporate Officer — Title(s): _____
 Partner — Limited General
 Individual Attorney in Fact
 Trustee Guardian or Conservator
 Other: _____
Signer Is Representing: _____

Signer's Name: _____
 Corporate Officer — Title(s): _____
 Partner — Limited General
 Individual Attorney in Fact
 Trustee Guardian or Conservator
 Other: _____
Signer Is Representing: _____



9025 N. Lindbergh Dr. | Peoria, IL 61615
Phone: (800)645-2402 | Fax: (309)689-2036

POWER OF ATTORNEY

RLI Insurance Company

Contractors Bonding and Insurance Company

Know All Men by These Presents:

That this Power of Attorney is not valid or in effect unless attached to the bond which it authorizes executed, but may be detached by the approving officer if desired.

That this Power of Attorney may be effective and given to either or both of **RLI Insurance Company** and **Contractors Bonding and Insurance Company**, required for the applicable bond.

That **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, each Illinois corporations (as applicable), each authorized and licensed to do business in all states and the District of Columbia do hereby make, constitute and appoint:

Mark D. Iatarola, Michelle M. Basuil, John Maloney, Helen Maloney, jointly or severally

in the City of Escondido, State of California, as Attorney in Fact, with full power and authority hereby conferred upon him/her to sign, execute, acknowledge and deliver for and on its behalf as Surety, in general, any and all bonds, undertakings, and recognizances in an amount not to exceed Ten Million Dollars (\$10,000,000.00) for any single obligation.

The acknowledgment and execution of such bond by the said Attorney in Fact shall be as binding upon this Company as if such bond had been executed and acknowledged by the regularly elected officers of this Company.

RLI Insurance Company and **Contractors Bonding and Insurance Company**, as applicable, have each further certified that the following is a true and exact copy of the Resolution adopted by the Board of Directors of each such corporation, and now in force, to-wit:

"All bonds, policies, undertakings, Powers of Attorney or other obligations of the Corporation shall be executed in the corporate name of the Corporation by the President, Secretary, any Assistant Secretary, Treasurer, or any Vice President, or by such other officers as the Board of Directors may authorize. The President, any Vice President, Secretary, any Assistant Secretary, or the Treasurer may appoint Attorneys in Fact or Agents who shall have authority to issue bonds, policies or undertakings in the name of the Corporation. The corporate seal is not necessary for the validity of any bonds, policies, undertakings, Powers of Attorney or other obligations of the Corporation. The signature of any such officer and the corporate seal may be printed by facsimile or other electronic image."

IN WITNESS WHEREOF, **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, as applicable, have caused these presents to be executed by its respective Vice President with its corporate seal affixed this 2nd day of October, 2015.

State of Illinois }
County of Peoria } SS



RLI Insurance Company
Contractors Bonding and Insurance Company
B. W. Davis
Barton W. Davis Vice President

CERTIFICATE

On this 2nd day of October, 2015, before me, a Notary Public, personally appeared Barton W. Davis, who being by me duly sworn, acknowledged that he signed the above Power of Attorney as the aforesaid officer of the **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company**, and acknowledged said instrument to be the voluntary act and deed of said corporation.

I, the undersigned officer of **RLI Insurance Company**, and/or **Contractors Bonding and Insurance Company**, each Illinois corporations, do hereby certify that the attached Power of Attorney is in full force and effect and is irrevocable; and furthermore, that the Resolution of the Company as set forth in the Power of Attorney, is now in force. In testimony whereof, I have hereunto set my hand and the seal of the **RLI Insurance Company** and/or **Contractors Bonding and Insurance Company** this 6TH day of NOVEMBER, 2015.

Jacqueline M. Bockler
Jacqueline M. Bockler Notary Public

RLI Insurance Company
Contractors Bonding and Insurance Company
B. W. Davis
Barton W. Davis Vice President



Bid Results for Project SBWRP Sludge Pump & Ginder Installation (L-16-1374-DBB-2)
Issued on 10/15/2015
Bid Due on November 12, 2015 1:30 PM (Pacific)
Exported on 11/12/2015

VendorID	Company Name	Address	City	ZipCode	Country	Contact	Phone	Fax	Email	Vendor Type
302492	Tharsos Inc	7839 University Ave, #210	La Mesa	91942	United States	Michael Lopez	619-464-1261	691-241-8514	tharsosconstruction@gmail.com	LAT,MALE,ELBE,PQ,UAL,DBE,Local

Responsee	Responsee Title	Responsee Phone	Responsee Email
Michael Lopez	President	619-669-8377	tharsosconstruction@gmail.com

Bid Format	Submitted Date	Status	Confirmation #	Ranking
Electronic	November 12, 2015 1:29:53 PM (Pacific)	Submitted	67645	0

Attachments		
File Title	File Name	File Type
Bid Bond	Bid Bond.pdf	General Attachments
Pending Action	Pending Actions.pdf	General Attachments
Benefits	Benefits Ordinance.pdf	General Attachments
Bid Bond	Bid Bond.pdf	Bid Bond

Line Items							
Item Num	Section	Item Code	Description	Unit of Measure	Quantity	Unit Price	Line Total
1	Main Bid	237110	General Construction	LS	1	\$318,615.00	\$318,615.00
2	Main Bid	237110	Final Approval of Operation & Maintenance Manual (or Ownwr's Manuals) and Master Record Documents(Stipulates	LS	1	\$988.00	\$988.00
3	Main Bid	524126	Bonds (Payment and Performance)	LS	1	\$5,926.00	\$5,926.00
4	Main Bid	237110	Mobilization	LS	1	\$6,914.00	\$6,914.00
5	Main Bid		Field Orders - Type II	AL	1	\$40,000.00	\$40,000.00
6	Main Bid	541330	Water Pollution Control Program Development	LS	1	\$1,738.00	\$1,738.00
7	Main Bid	237990	Water Pollution Control Program Implementation	LS	1	\$2,319.00	\$2,319.00
						Subtotal	\$376,500.00
						Total	\$376,500.00

Subcontractors									
Name	Description	License Num	Amount	Type	Address	City	ZipCode	Country	
Sapphire Electric, Inc.	electrical	809701	\$64,767.00	ELBE	1948 Don Lee Place, Suite 1	Escondido	92029	United States	

Self-Performance
0.1720