MR. David J. Kleiss, Vice-President
J.R. Filanc Construction, Inc.
740 N. Andereasen Drive
Escondido, CA 92029
P: (760) 941-7130 F: (760) 941-3969

City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633
I.daRosa/NB/egz

REQUEST FOR PROPOSAL (RFP)

ORIGINAL

FOR

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

RFP NO.:	**5573**
BID NO.:	**K-13-5573-DB2-3**
SAP NO. (WBS/IO/CC):	**S-00339**
CLIENT DEPARTMENT:	**2011**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BO**

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- PHASED FUNDING
- FEDERAL EQUAL OPPORTUNITY CONTRACTING REQUIREMENTS.
- PREVAILING WAGE RATES: **STATE, FEDERAL OR BOTH**
- THIS IS A CLEAN WATER STATE REVOLVING FUND CONTRACT THROUGH THE STATE OF CALIFORNIA.

PROPOSAL DUE:

12:00 NOON
FEBRUARY 6, 2013
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1010 SECOND AVENUE SUITE 1400, MS 614C
SAN DIEGO, CA 92101

TABLE OF CONTENTS

SECTION		PAGE NUMBER
1.0	INTRODUCTION	4
2.0	EQUAL OPPORTUNITY	4-5
3.0	PROJECT BACKGROUND AND DESCRIPTION	5
4.0	SCOPE OF REQUIRED WORK AND SERVICES	5
5.0	SELECTION PROCESS	5-9
6.0	POLICIES, PROCEDURES AND GUIDELINES	9
7.0	EVALUATION CRITERIA	9
8.0	SELECTION AND AWARD SCHEDULE	10
9.0	PRE-PROPOSAL ACTIVITIES	10
10.0	SPECIAL CONDITIONS	11-13

ATTACHMENTS

A	PROJECT DESCRIPTION, SCOPE OF WORK, TECHNICAL SPECIFICATIONS, AND BRIDGING DOCUMENTS	14-336
B	PROPOSAL SUBMITTAL REQUIREMENTS AND SELECTION CRITERIA	337-339
C	CONTRACT FRONT END VOLUME 1	340-342
	1. REQUIRED DOCUMENTS SCHEDULE	343-346
	2. DBE SPECIAL NOTICE	347-348
	3. INVITATION TO BIDS	349
	4. INSTRUCTION TO BIDDERS	350-358
	5. FUNDING AGENCY PROVISIONS	359
	1. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)	359
	2. Nondiscrimination Provisions for Federally Assisted Construction Contracts	359-360
	3. Equal Opportunity Clauses	361
	4. Standard Federal Equal Employment Specifications	361-363
	5. Violation or Breach of Requirements	363
	6. Monthly Employment Utilization Reports	363
	7. Records of Payments to DBE	363
	8. Federal Wage Requirements for Federally Funded Projects	364
	9. State Requirements for Contracts Subject To State Prevailing Wage Requirements	364-365

10. Wage Rates 366-391
11. Federal Labor Standards Provisions 392-397
12. Agency Specific Provisions 398-400
13. DBE Potential Resources Centers 400-402
14. Good Faith Effort Documentation Submittals 402
15. Forms 402-403

16. ATTACHMENTS 403
1. EPA FORM 6100-2 DBE Subcontractor Participation Form 404
2. EPA Form 5700-52A DBE Subcontractor Performance Form 405-410
3. CWSRF Form 1 Good Faith Effort List of Subcontractors Solicited . 411
4. CWSRF Form 2 Good Faith Effort Bids Received List 412
5. CWSRF Form 3 Contractor Certification 413
6. CWSRF Form 4 Prime Contractor/Recipient Selected DBEs 414
7. CWSRF Form 5 Summary of Bids Received from Subcontractors 415
8. AA61 List of Work Made Available 416

17. CONTRACT FORMS
1. Design-Build Agreement 417-418
2. Performance Bond and Labor and Materialmen's Bond 419-420

18. CONTRACTOR CERTIFICATION
1. Drug-Free Workplace 421
2. American with Disabilities Act (ADA) Compliance 422
3. Contractor Standards - Pledge of Compliance 423
4. Affidavit of Disposal 424
5. Phased Funding Schedule 425

19. SUPPLEMENTARY SPECIAL PROVISIONS 426-494

20. APPENDICES:
- APPENDIX A Testing Standards For Electrical Components 495
- APPENDIX B Materials Typically Accepted by Certificate of Compliance 496-497
- APPENDIX C Sample City Invoice 498-499
- APPENDIX D Adjacent Projects 500-501

D CONTRACT FRONT END VOLUME 2 502-504
1. Bid/Proposal 505-507
2. Non-Collusion Affidavit to be executed by Bidder and Submitted with Bid under 23 USC 112 and PCC 7106 508
3. Contractors Certification of Pending Actions 509
4. Equal Benefits Ordinance Certification of Compliance 510
5. Lobby Prohibition, Certification and Disclosure 511
6. Instructions for Completion of SF-LLL, Disclosure of Lobbying Activities 512
7. Disclosure of Lobbying Activities 513-514
8. Design-Build Proposal 515
9. Price Proposal Forms (Design Build) 516-518
10. Form AA05 - Design-Build List of Subcontractors 519
11. Form AA15 - Design-Build List of Subcontractors 520
12. Form AA25 - Design-Build Named Equipment/Material Supplier List 521
13. Form AA30 - Design-Build Named Equipment/Material Supplier List 522
14. EPA FORM 6100-3 - DBE Subcontractor Performance Form 523
15. EPA FORM 6100-4 - DBE Subcontractor Utilization Form 524

1.0 INTRODUCTION

1.1 This is the City of San Diego's (City) second step (in a 2-step process) in the selection process to provide Design-Build services for the **MBC Dewatering Centrifuges Replacement Design – Build Contract** (Project).

1.2 This RFP is being issued to the selected firms for this selection process exclusively. These firms are:

1. Black and Veatch Corporation
2. J. R. Filanc Construction Company, Inc.

Proposals from any other firms will not be considered for this process and will be rejected as unsolicited Proposals.

The Design-Builder shall ensure that Design-Builder's license(s) shall be valid when Proposal is submitted. Failure to comply with this requirement will result in:

1) The rejection of the Proposal.

1.3 **CONSTRUCTION COST:** The City's estimated construction cost for this contract is **$9,170,000.**

1.4 This RFP describes the Project, the required scope of Work and Services, the Design-Builder selection process, and the minimum information that shall be included in the Proposal. Failure to submit information in accordance with this RFP's requirements and procedures may be cause for disqualification.

1.5 Any architectural firms, engineering firms, specialty consultants, or individuals retained by the City to assist in drafting the RFPs or the Project's preliminary design shall not be eligible to participate in the competition with any Design-Build Entity without the prior written consent of City. Any architectural firms, engineering firms, specialty consultants, or individuals retained by the City to assist in drafting any Reference Documents, such as the Water Department's Master Plan and any other document that was not prepared specifically for this contract, are considered to be eligible to participate.

2.0 EQUAL OPPORTUNITY

2.1 All information provided and requirements set forth in Section 2 of the Request for Qualifications (RFQ) for the Project shall apply to this RFP process. The Design-Builder shall review the information, data, and documentation provided in the Design-Builder's Statement of Qualification (SOQ) and changes shall be identified in the Proposal; otherwise the information, as previously submitted, will be deemed complete and accurate.

2.2 As set forth in this RFP, the City is dedicated to the principles of equal opportunity in the workplace and in subcontracting. It is the City's expectation that firms doing business with the City have, and are able to demonstrate, the same level of commitment.

2.3 The Design-Builders are encouraged to take positive steps to diversify and expand their subcontractor solicitation base and to offer contracting opportunities to all eligible certified Subcontractors in accordance with the City's EOCP requirements included in the Contract Documents.

2.4 For Subcontractor Participation Requirements see Attachment C Contract Front End Volume 1 for more information

3.0 PROJECT BACKGROUND AND DESCRIPTION

See Attachment A.

4.0 SCOPE OF WORK AND SERVICES

Work and Services required of the Design-Builder include those during design, construction, and startup of the Project. The Design-Builder shall provide all management, supervision, labor, services, equipment, tools, supplies, temporary facilities, and any other item of every kind and description required for the complete design and construction and operation of the Project, as described in Attachment A.

5.0 SELECTION PROCESS

Each Design-Builder shall submit separate "Technical" and "Price" Proposals as described in this RFP.

5.1 Technical Proposal Requirements

5.1.1 Failure to comply with this section will render the Design-Builder's submittal invalid and disqualify it from this selection process.

5.1.2 The Technical Proposal shall be concise and well organized and shall demonstrate the Design-Builder's qualifications and experience applicable to the Project. Type size and margins for text pages shall be in accepted standard formats for desk top publishing and word processing and result in no more than 500 words per page.

NOTE: A cover letter may be submitted but SHALL not contain any information that is a required element of the Technical Proposal (i.e. acknowledgement of addenda)

5.1.3 The Design-Builder shall certify that the documentation required under the Work Force Report and Equal Employment Opportunity (EEO) Plan and the Subcontractor Documentation of the RFQ remains correct and accurate. If any changes or modifications are required to the aforementioned documents, they shall be documented in the Work Force Report and EEO Plan forms included in the Contract Documents as attachments and submitted with the Proposal.

The EOCP information not revealing the Contract Price shall be submitted with the Technical Proposal.

5.1.4 The Technical Proposals submitted in response to this RFP shall be in accordance with the requirements listed in Attachment B. The contents of the Proposal shall be organized consistent with the Attachment B.

5.2 Price Proposal Requirements

5.2.1 One executed original, clearly marked on the cover, of the Price Proposal shall be submitted in a separate sealed envelope. Refer to Attachment 'D' of this RFP for the Price Proposal form to be used.

5.2.2 The Price Proposal shall be signed by an individual or individuals authorized to execute legal documents on behalf of the Design-Builder.

5.2.3 The lowest proposed price is not the determining factor for award of this contract. See Attachment 'B' for criteria from which the proposals will be evaluated.

5.2.4 In case of discrepancies, written numbers will govern over numerical. The summation of all lump sum, unit prices, allowances and any other priced items will govern over the total price in case of discrepancies between the two.

5.2.5 Certain EOCP information (i.e., Subcontractors and Suppliers listings) that indicates the dollar value of the portions of the work to be performed by the Subcontractors and Suppliers shall be submitted as part of the Price Proposal.

5.3 Submittal Requirements

5.3.1 Technical Proposal

5.3.1.1 The Technical Proposal shall be received no later than the time and date shown on the cover of this RFP.

5.3.1.2 One executed original, clearly and conspicuously marked on the cover, and 6 copies are to be submitted in a sealed package marked "Technical Proposals" clearly and conspicuously in its face. The following information will be clearly marked on the outside of each package:

Name of Design-Builder
Project Title
"Technical Proposal" Package Number (e.g., 1 of 16, 2 of 16, etc.)
Marked "CONFIDENTIAL" (in red)

5.3.1.3 The Technical Proposal shall be signed by an individual or individuals authorized to execute legal documents on behalf of the Design-Builder.

The Design-Builder shall provide the names of the principal individual owners of the firm. In the event the firm is employee owned or publicly held, then the fact shall be stated and the names of the firm's principals or officers shall be provided.

5.3.1.4 Failure to comply with the requirements of this RFP may result in disqualification.

5.3.1.5 Technical Proposals and modifications thereto received subsequent to the hour and date specified above will render the Design-Builder's submittal invalid and will cause its disqualification from this selection process.

5.3.1.6 Proposals that deviate from the RFP and Bridging Documents supersede the RFP in accordance with 2-5.2, "Precedence of Contract Documents."

Design elements which deviate from the scope of Work, City's design guidelines, or material substitution which differs from the Approved Material List shall be highlighted in accordance with Attachment B, "Exception to this RFP" of the Proposal and brought to City's attention during the presentation and interview.

5.3.1.7 Questions about the meaning or intent of the Contract Documents as related to the scope of Work and of technical nature shall be directed to the Project Manager prior to the Proposal due date. Interpretations or clarifications considered necessary by the Project Manager in response to such questions will be issued by Addenda, which will be uploaded to City's online service(s) e.g., e-Bidboard (or mailed or delivered to all parties recorded by the City as having received the Contract Documents).

Questions received less than 14 days prior to the Proposal due date may not be answered. Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarifications will 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 Proposal.

5.3.2 Price Proposal

5.3.2.1 The Price Proposal shall be submitted separately from the Technical Proposal and shall be received no later than the time and date shown on the cover of this RFP.

Submittal of the Price Proposal after the date stipulated in this section will be cause for rejection of the entire Proposal and disqualification of the Design-Builder for this selection process.

5.3.2.2 The Price Proposal is to be submitted in sealed packages with the following information clearly marked on the outside of each package:

Name of Design-Builder
Project Title
"Price Proposal" Marked "CONFIDENTIAL" (in red)

5.3.2.3 Failure to comply with the requirements of this RFP may result in disqualification.

5.3.2.4 Price Proposals or modifications thereto received subsequent to the hour and date specified above will render the Design-Builder's submittals invalid and will cause their disqualification in the selection process.

5.4 Review of Technical Proposal

5.4.1 Following the receipt of the Technical Proposal, the City anticipates allotting 2 weeks for review of the Technical Proposals.

5.4.2 Subsequent to receipt, the City will provide written notice of the schedule for technical presentations. This schedule will be on a "random draw" basis and has no bearing on the potential for award.

5.5 Technical Presentation

5.5.1 The interview will consist of a (25) minute presentation by the Design-Builder and (25) minutes of questions by the Panel. The presentation shall be presented by the Design-Builder's key personnel who will be continuously involved on site or in San Diego, in relative proportion to their level of involvement. Based on the Design-Builder's Proposal, interview and the Project's Evaluation Criteria, the Panel will rank the Design-Builder's of its qualifications.

5.5.2 The Design-Builders are responsible for bringing any and all equipment and materials that are required for the presentation. The City will not provide any equipment or materials for presentations.

5.6 Final Selection (Adjusted Low Bid)

5.6.1 The ranking of each Design-Builder during the Technical Proposal review and the Interviews will serve as a divisor of the Price Proposal submitted thereby determining weighted price.

5.6.2 Selection will be based on "Adjusted Low Bid". Following review of the Technical Proposals and the oral presentations/interviews, the resulting qualitative evaluation scores will be totaled on a scale of 0 to 100, and will be converted to a decimal (e.g., score of 85 is written as 0.85). After the scores have been calculated, each Design-Builder's price envelope will be opened. The price will be divided by the score (expressed as a decimal) to yield the "Adjusted Low Bid". The lowest adjusted bid will be recommended for Contract award. The adjustment to the Price Proposal is for selection purposes only. The Price Proposal as submitted is the actual Contract Price.

The following example summarizes and illustrates the process:

Design-Builder	Qualitative Score (100 Maximum)	Price Proposal	Adjusted Price *
A	0.85	$1,000,000.00	$1,176,471
B	0.95	$1,300,000.00	$1,368,421
C	0.65	$900,000.00	$1,384,615
* The adjustment to the Proposal is for selection only. Firm "A" has Adjusted Lowest Bid. The Price Proposal is the actual Contract amount.			

5.6.3 The Design-Builders will be notified in writing of the City's final decision.

6.0 Policies, Procedures and Guidelines

6.1 The Program's Selection Process is based on the policies, procedures and guidelines contained in the City Municipal Code Chapter 2, Article 2, Division 33.

6.2 A Ranking Panel (Panel) will be established for this project and will include representatives from the City and may include other interested parties (e.g., Participating Agencies, representative from the Community at Large, as required and other agencies e.g., the State Water Resource Control Board, etc.).

6.3 The Panel will review all proposals received and when required interview each Design-Builder in accordance with Attachment 'B' of this RFP. Based on the Design-Builder's Proposal, interview and the Project's Evaluation Criteria, the Panel will rank the Design-Builders as to qualifications in a public meeting. The Panel will forward its ranked listing of Design-Builders to the Mayor or designee. The public meeting will be held at **2:30 PM** at Public Works Contracting Group, 1010 Second Avenue Suite 1400 MS 614C, San Diego, California, 92101 as scheduled in Section 8.

6.4 The Mayor or designee will make the final recommendation to City Council concerning the proposed agreement. The City Council has the final authority to approve the Contract.

7.0 EVALUATION CRITERIA

The evaluation criteria and the respective weights that will be given to each criterion are attached as Attachment 'B'.

8.0 SELECTION AND AWARD SCHEDULE

The City anticipates that the process for selecting a Design-Builder, and awarding the contract, will be according to the following tentative schedule:

8.1	Pre-Proposal Meeting	January 16, 2013
8.2	Proposal Due Date	February 6, 2013
8.3	Interviews	February 14, 2013
8.4	Public Ranking Meeting	February 27, 2013
8.5	Selection and Notification	March 14, 2013
8.6	Receipt of Bonds and Insurance Certificates	April 4, 2013
8.7	Notice to Proceed	May 7, 2013

9.0 PRE-PROPOSAL ACTIVITIES

9.1 Questions Concerning RFP

All questions regarding the RFP shall be presented in writing to the Contract Specialist at the USPS or the e-mail address identified on the cover sheet of the RFP.

9.2 Pre-Proposal Meeting

A Pre-Proposal meeting will be held from 10:00 AM to 11:00 AM, in the MBC large conference room, at 5240 Convoy Street, San Diego, CA, 92111. All potential responders are REQUIRED to attend. Any materials distributed at the meeting will be issued to all RFP recipients in the form of an addendum to this RFP. It is not necessary for all members of a Design-Builder's team to be present at the Pre-Proposal Meeting, however, the Design-Builder will be held accountable for receiving and applying all information discussed at the Pre- Proposal Meeting.

Bid shall be considered non-responsive if the Design-Builder fails to attend the Pre-Proposal Meeting as evidenced by the City's meeting sign-in sheet when such a meeting has been specified to be required.

9.3 Pre-Proposal Site Visit

The Design-Builders are encouraged to visit the Work Site with the Engineer. The purpose of the Site Visit is to acquaint Design-Builders with the Site conditions. To request a sign language or oral interpreter for this visit, call the Public Works Contracting Group at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. A Pre-Proposal Site Visit is scheduled as follows:

Time:	**10:00 a.m.**
Date:	**JANUARY 16, 2013**
Location:	**5240 Convoy Street, San Diego, CA 92111**

9.4 Revision to the RFP

The City reserves the right to revise the RFP prior to the date that Proposals are due. Revisions to the RFP will be mailed to all RFP holders. The City reserves the right to extend the date by which the Proposals are due.

10.0 SPECIAL CONDITIONS

10.1 Reservations

This RFP does not commit the City to award a contract, to defray any costs incurred in the preparation of a Proposal pursuant to this RFP, or to procure or contract for Work.

10.2 Public Records

After the selection process is complete and a contract is signed between the City and the winning Design-Builder, all Proposals submitted in response to this RFP become the property of the City and public records, and as such may be subject to public view.

10.3 Right to Cancel

The City reserves the right to cancel, in part or in its entirety, this RFP including but not limited to: selection schedule, submittal date, and submittal requirements. If the City cancels or revises the RFP, all Design-Builders will be notified in writing by the City.

10.4 Additional Information

The City reserves the right to request additional information or clarifications from or interview any or all Design-Builders.

10.5 Public Information

Release of Public Information - Selection announcements, contract awards, and all data provided by the City shall be protected from public disclosure. Design-Builders desiring to release information to the public, shall receive prior written approval from the City.

10.6 Changes to Key Personnel and Substitution of Subcontractors

10.6.1 The Design-Builder shall not change or substitute any individual that is identified as "key personnel" in its SOQ and Proposal without the written consent of the City.

10.6.2 The Design-Builder shall not change or substitute any material, Supplier Subconsultants, or Subcontractor identified in its SOQ and Proposal without written consent of the City.

10.7 Use of Reference Documents and Pre-Design Reports

10.7.1 The City has made available As-Built Plans and Reference Documents related to the Project. Use of these reports shall be for general project background information only, and shall be used at the Design-Builder's risk. No responsibility is assumed by the City for the completeness or accuracy of these reports.

10.7.2 The following documents are attached to the Scope of Work (Attachment 'A'):

a. Alfa Laval Scope of Supply
b. Geotechnical Field and Laboratory Test Data
d. Vicinity Map

10.8 Use of Computer Aided Drafting and Design (CADD)

The Design-Builder shall use CADD. CADD drawings, figures, and other work shall be produced by the Design-Builder using MicroStation software. Conversions of CADD work from any other non-standard CADD format to City standard MicroStation format shall not be acceptable in lieu of this requirement unless specified otherwise in the Contract Documents. Refer to City's CADD Standards for detailed requirements at:

http://www.sandiego.gov/engineering-cip/services/consultcontract/edocref/index.shtml

10.9 Scheduling and Management Reporting Systems

The Design-Builder will be required to use the latest version of the Primavera Project Management and Scheduling Software or equal.

10.9.1 The City will require the Design-Builder to submit and maintain a task-oriented computerized schedule for completing the Work over the life of the Project.

10.9.2 The Design-Builder shall anticipate that the development of this schedule will require at least 3 steps; (1) development of a work breakdown structure by the Design-Builder and submittal to the City for review; (2) development of interface procedures (and software, if necessary) to communicate from the Design-Builder's computer networking software to the City's networking software (Primavera), and (3) development of an activity network for submittal to the City for review and concurrence.

10.9.3 The Design-Builder will be required to furnish activity status and network updates on disks in a format that will interface with the City's scheduling system. The City will utilize the schedule information supplied by the Design-Builder in to review progress payments and to monitor the progress of the project against the agreed schedule requirements.

10.10 Project Schedule

10.10.1 The City has established the following tentative milestones for the Project:

a.	Approve project schedule (Primavera)	May 20, 2013
b.	Start Operation of first set (2) Centrifuges	June 19, 2014
c.	Start Operation of second set (2) Centrifuges	December 2, 2015
d.	Start Operation of third set (2) Centrifuges	August 11, 2017

For the Contract Time refer to Contract Front End Volume 1, Invitation to Bids (see Attachments).

10.11 Acknowledgement of Addenda

The Design-Builder shall confirm in its Proposal the receipt of all addenda issued to this RFP. Failure to acknowledge all addenda issued, will result in the Proposal being considered **non-responsive** and ineligible for further consideration.

10.12 The agreement, terms and conditions are included in The City's Front End Contract Documents Volume 1 and 2, The GREENBOOK Part 1, and The WHITEBOOK e.g., the City Supplement.

10.13 This contract is funded by the Clean Water State Revolving Fund. The Design-Builder shall comply with all the funding source requirements. See Attachment C Contract Front End Volume 1 for more information.

ATTACHMENT A

PROJECT DESCRIPTION, SCOPE OF WORK, TECHNICAL SPECIFICATIONS, AND BRIDGING DOCUMENTS

ATTACHMENT A

PROJECT DESCRIPTION, SCOPE OF WORK, TECHNICAL SPECIFICATIONS, AND BRIDGING DOCUMENTS

PUBLIC WORKS DEPARTMENT

1.0 Project Description:

This project is subject to phased funding. Two (2) centrifuges shall be funded in fiscal year (FY) 2013, and two (2) more shall be funded in each of the following fiscal years (FY 2014 and FY 2015). During replacement of centrifuges, no more than one (1) unit shall be taken out of the service at a time. (Required to maintain dewatering capacity).

2.0 Scope of Work:

The scope of work includes the following:

a. Preparation of design documents for this contract, including plans and specifications. Design-Builder shall prepare project documents at the 30%, 60%, 100%, and final design level for the Construction Manager's and Owner's review. The Design-Builder shall also be responsible for updating the as-built drawings for all engineering disciplines applicable.

b. Removal and salvage of existing centrifuges. No more than one centrifuge shall be taken out of service at any time. Refer to Section 7-18.b for Design-Builder responsibilities.

c. The salvaged centrifuges and controls shall become the property of the Design-Builder once removed from the site. The Owner will retain two of the salvaged centrifuge controllers. It is the intent of this contract that the Design-Builder shall sell or otherwise provide beneficial use of the remaining four centrifuge controllers and all six removed centrifuges once removed from the site.

d. Demolition of equipment concrete pads, piping, wiring, electrical panels, and miscellaneous appurtenances as necessary to accommodate the new centrifuges.

e. Design of equipment pads and sub-bases, wiring, valves, piping, and miscellaneous appurtenances required for the proper operation of the new centrifuges. As-built drawings and figures provided in this attachment shall be used only for reference. Design-Builder shall field verify all project conditions including but not limited to measurements, equipment present, and all associated piping, valves, supports, panels, and appurtenances.

f. Installation of two new centrifuge feed lines and motorized pinch valves necessary for operation of new centrifuges.

g. Installation of six new dewatering centrifuges including all appurtenances. In order to retain dewatering capacity, no more than one centrifuge shall be taken out of service. New centrifuges shall be installed, tested, and placed into service one unit at a time.

h. Remove and salvage existing controls, and supply new control system equipment including panels/cabinets to connect the existing SCADA system to the new centrifuges.

i. Furnishing spare parts and tools for maintenance of new centrifuges, as specified in the contract.

j. Startup and testing of new centrifuges, including furnishing services of manufacturer's representative as specified in the contract, equipment for testing, and miscellaneous services such as laboratory testing. Centrifuges shall be tested to 400 gallons per minute. The Design-Builder should note that achieving this flow rate (400 gallons per minute) will require

utilization of two of the existing sludge feed pumps. Engineer/Designer of Record shall review the startup plan prior to submitting to the Construction Manager for approval. The Engineer/Designer of Record shall also be present during the startup as necessary.

k. Providing operation and maintenance training, including furnishing services of manufacturer's representative for conducting the training.

l. Providing insurance and bonds as specified in the contract.

m. During construction, the Engineer/Designer of Record shall attend a minimum of 50% of the construction meetings, or greater, if required by the Construction Manager.

The Owner has selected Alfa Laval, Inc. as the supplier who will furnish the centrifuges. Attachment A-1 details the Scope of Supply that Alfa Laval has proposed when furnishing the centrifuges. The Scope of Supply includes items (i) through (k) listed above, in part or in whole.

3.0 Reference Standards:

1. STANDARD SPECIFICATIONS

Document No.	Filed	Description
PITS0504091	05-04-09	Standard Specifications for Public Works Construction (The GREENBOOK), 2009 Edition
PITS090110-1	09-01-10	City of San Diego Standard Specifications for Public Works Construction (The WHITEBOOK), 2010 Update *
AEC1231064	12-31-06	California Department of Transportation, Manual of Uniform Traffic Control Devices (MUTCD 2006)
769023	09-11-84	Standard Federal Equal Employment Opportunity Construction Contract Specifications and the Equal Opportunity Clause

NOTE: The City of San Diego Supplement, 2010 Update now consolidates various City Public Works Construction Standard Specifications which in the past were included in the Supplementary Special Provisions. The Bidders' attention is directed to this edition of the City Supplement for a close review to ensure no important information is missed for the preparation of the Bids.

2. STANDARD DRAWINGS

Document No.	Filed	Description
PITS09011002	09-01-10	City of San Diego Standard Drawings *
N/A	Varies	City Standard Drawings - Updates Approved For Use (when specified)*
AEC0925061	09-25-06	Caltrans 2006 U.S. Customary Unit Standard Plans

NOTE: *Available online under Engineering Documents and References at: http://www.sandiego.gov/engineering-cip.

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 of dewatering centrifuges in Area 76.

B. The DESIGN-BUILDER shall remove dewatering centrifuges 76-DC-2 through 76-DC-7, and associated appurtenances including control panels located in the motor control center (MCC). Salvaged centrifuges and controls shall become the property of the DESIGN-BUILDER once removed from the site. Appurtenances such as wiring, conduits, piping, and supports required for installation and operation of the new centrifuges shall be preserved in place as necessary to facilitate the WORK.

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 6-8.2.4 of the Supplementary Special Provisions

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the DESIGN-BUILDER shall comply with the Standard Specifications for Public Works Construction (SSPWC), 2009 Edition (Greenbook) and the City of San Diego Standard Specifications for Public Works Construction 2010 Edition (Whitebook).

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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Demolition Schedule: The DESIGN-BUILDER 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 DESIGN-BUILDER.

B. If, during demolition work, any additional asbestos materials are being discovered, the DESIGN-BUILDER shall stop the work immediately and notify the CONSTRUCTION MANAGER for further instructions. Work interruptions caused thereby are subject to the provisions in Section 3 of the Greenbook and Section 3 of the Whitebook.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 GENERAL

A. Structures shall be demolished and removed in compliance with Section 7.9 of the Greenbook and the Whitebook, Section 802 of the Whitebook, and the requirements indicated herein.

3.2 POLLUTION CONTROL

Not Used

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 in compliance with Section 7.9 of the Greenbook and Whitebook.

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 and in accordance with Section 7.9 of the Greenbook and the Whitebook.

D. Unless otherwise indicated, the DESIGN-BUILDER shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. The DESIGN-BUILDER 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

Not Used

3.5 BELOW-GRADE DEMOLITION

Not Used

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 with Section 802 of the Whitebook. Burning of removed materials from demolished structures shall not be permitted.

C. Salvaged centrifuges and control panels shall become the property of the DESIGN-BUILDER once removed from the site. It is the intent of this contract that the DESIGN-BUILDER shall sell or otherwise provide beneficial use of the centrifuges once removed from the site.

3.7 PATCHING AND REPAIRING

A. The DESIGN-BUILDER shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent surfaces.

B. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a clean condition in accordance with Section 6-8.2.4 of the Supplementary Special Provisions.

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.

**** 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 05500 Miscellaneous Metalwork
2. Section 11002 Equipment Supports, Grouting and Installation

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the DESIGN-BUILDER shall comply with the Standard Specifications for Public Works Construction (SSPWC), 2009 Edition (Greenbook) and the City of San Diego Standard Specifications for Public Works Construction 2010 Edition (Whitebook). The current versions of the following standards shall also 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 Surfacings

ASTM C 579 Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings

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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 DESIGN-BUILDER.

5. The cost of all laboratory tests on grout will be borne by the OWNER, but the DESIGN-BUILDER shall assist the CONSTRUCTION MANAGER in obtaining specimens for testing. However, the DESIGN-BUILDER shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The DESIGN-BUILDER 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.

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 degrees F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 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 x 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 the SSPWC shall apply except as indicated otherwise herein.

B. Topping grout and concrete fill shall contain a minimum of 564 pound of cement per cubic yard with a maximum water cement ratio of 0.45.

C. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
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 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: BurkEpoxy Anchoring Grout by the Burke Company

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in the SSPWC. 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 a 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

C. The WORK of this Section includes providing miscellaneous metalwork and appurtenances including the following:

1. Anchor Bolts
2. Power Driven Pins
3. Bolts
4. Seat Angles, Supports and Brackets
5. Gratings

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 03315 Grout
2. Section 09800 Protective Coating

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. Uniform Building Code

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the DESIGN-BUILDER shall comply with the Standard Specifications for Public Works Construction (SSPWC), 2009 Edition (Greenbook) and the City of San Diego Standard Specifications for Public Works Construction 2010 Edition (Whitebook).

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 A 36	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 A283	Specification for Low and Intermediate Tensile StrengthCarbon Steel Plates, Shapes and Bars
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A320	Specification for Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM A489	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 B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
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)
ANSI/AWS D1.1	Structural Welding Code - Steel
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Shop drawings showing connection details and locations proposed for power driven pins.

2. Shop drawings of miscellaneous metalwork including seat angles, supports and guides.

3. Shop drawings showing proposed use of adhesive anchors.

4. Data indicating load capacities, chemical resistance and temperature limitations of power driven pins.

5. Manufacturer's catalog data for each type of anchor.

6. Welding procedures and welder qualifications.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 A283.

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 except as otherwise indicated.

C. **Stainless Steel:** Stainless steel metalwork shall be of Type 316 L stainless steel. Stainless steel shall not be torch heated for welding. The DESIGN-BUILDER 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 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 ICBO report verifying strength and material equivalency. 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

A. **Materials:** Power-driven pins for installation in concrete or steel in interior locations of nonprocess areas shall be heat-treated steel alloy complying with AISI 1062 or 4063 and shall be zinc-plated. Pins shall have capped or threaded heads capable of transmitting the shank loads. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

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

A. Seat angles over slide gate guides shall be welded to the guides. Seat angles for supports for floor plates, clips for precast panels and brackets for piping shall be steel, hot-dip galvanized after fabrication unless otherwise indicated. Over tanks and channels seat angles and brackets shall be Type 316 L stainless steel.

B. Seat angles for grating shall be aluminum or steel as indicated, except that Type 316 L stainless steel shall be used over tanks and channels. Guides for slide gates shall be Type 316 L stainless steel.

2.6 IRON CASTINGS

Not Used

2.7 GRATINGS

A. **General:** Both bearing bars and cross bars shall be continuous. Openings shall be banded with bars having the same dimensions as the bearing bars. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and shall be peened or ground to a smooth surface. No single piece of grating shall weigh more than 80 pounds unless otherwise indicated.

Rough weld beads and sharp metal edges on gratings and plates shall be ground smooth. Welds exposed to view shall be uniform and neat. Welds to be galvanized shall be sandblasted prior to galvanizing.

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. Cutting, drilling, punching, threading and tapping shall be performed prior to hot-dip galvanizing.

1. Aluminum: Aluminum grating bearing bars and aluminum floor plates and cover plates shall be of alloy 6061-T6 conforming to ASTM B221. Aluminum grating cross bars shall be of an alloy conforming to either ASTM B221 (extrusions) or B210 (drawn).

   Unless otherwise indicated, grating shall be fabricated of aluminum. Bearing bars shall be punched to receive the cross bars. After insertion in the bearing bars, cross bars shall be deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings. Fabrication methods employing bending or notching of bearing or cross bars will not be permitted.

2. Steel: Steel grating bearing bars and cross bars shall be of welding quality mild carbon steel conforming to ASTM A569. Steel floor plates and cover plates shall be of structural quality steel conforming to ASTM A36.

   Steel grating shall be used only where indicated. Steel grating shall be hot-dip galvanized. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.

2.8 FLOOR AND COVER PLATES:

Not Used

2.9 STAIRS

Not Used

2.10 SAFETY STAIR TREADS

Not Used

2.11 FLOOR 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:

   Sika/FI System with Sikadur Injection Gel Epoxy
   Masterbuilders Concresive Epoxy Cartridge Dispensing System and Concresive Paste LPL

2. Glass Capsule Polyester Resin Adhesive Anchors:

   Hilti HV
   Molly Parabond

3. Expanding-Type Anchors:

   Phillips Drill Company "Red Head"
   McCullock Industries "Kwick-Bolt"

4. Steel Gratings:

   Irving Type IWA
   Gary Type GW

5. Field Repairs to Galvanizing:

   "Galvinox"
   "Galvo-Weld"

6. Aluminum Grating:

   Gary Galok
   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

A. Seat angles shall be set flush with the floor.

3.4 INSTALLATION OF POWER DRIVEN PINS:

A. Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Pin's Shank Material	Minimum Material's Thickness	Minimum Space Penetration in Supporting Material	From Pin's CL to Edge of Penetrated Material	Minimum
Minimum by Pin	**Penetrated Material**	**Pin Spacing**		
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

3.5 INSTALLATION OF GRATING, FLOOR AND COVER PLATES

A. Grating, floor and cover plates shall be field measured for proper cutouts and proper sizes.

3.6 INSTALLATION OF STAIRS AND LADDERS

Not Used

3.7 INSTALLATION OF SAFETY STAIR TREADS

Not Used

3.8 INSTALLATION OF FLOOR HATCHES

Not Used

3.9 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.

3.10 INSTALLATION OF MANHOLE FRAMES AND COVERS

Not Used

**** END OF SECTION ****

SECTION 09800 - PROTECTIVE COATING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes the protective coating of all indicated surfaces including surface preparation, pretreatment, coating application, touch-up, protection of surfaces not to be coated, cleanup, and all appurtenant work.

B. Definitions

1. The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, except galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

2. The term "DFT" shall mean minimum dry film thickness, without any negative tolerance.

C. The following surfaces shall not be protective coated hereunder unless indicated.

1. Concrete except in chemical(s) containment areas
2. Stainless steel
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Platform gratings, stair treads, door thresholds, and other walk surfaces

D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

E. Architectural Coatings: 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 05500 Miscellaneous Metalwork
2. Section 15020 Pipe Supports
3. Section 11397 Centrifuges

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. Uniform Building Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the DESIGN-BUILDER shall comply with the Standard Specifications for Public Works Construction (SSPWC), 2009 Edition (Greenbook) and the City of San Diego Standard Specifications for Public Works Construction 2010 Edition (Whitebook). The current versions of the following standards shall also apply to the WORK of this Section:

1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of the Steel Structures Painting Council, 40 24th Street, 6th Floor, Pittsburgh, PA 15222.

2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 281340, Houston, TX 77218-8340.

3. Commercial Standards:

ANSI A13.1	Scheme for Identification of Piping Systems
ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied
ANSI/AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
ANSI/AWWA D102	Painting Steel Water-Storage Tanks
SSPC-PA2	Measurement of Dry Coating Thickness with Magnetic Gauges
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 5 / NACE No. 1	White Metal Blast Cleaning
SSPC-SP 6 / NCAE No. 3	Commercial Blast Cleaning
SSPC-SP 7 / NACE No. 4	Brush-Off Blast Cleaning

SSPC-SP 10 / NACE No. 2	Near-White Blast Cleaning
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

4. Federal Specifications:

TT-P-28	Paint, Aluminum, Heat Resisting (1200^{O}F)
DOD-P-23236	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions unless indicated otherwise.

B. Submittals shall include the following information and be submitted at least 30 days prior to protective coating work.

1. Coating Materials List: The DESIGN-BUILDER shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein, prior to or at the time of submittal of samples.

2. Paint Manufacturer's Catalogue: For each paint system to be used the DESIGN-BUILDER shall submit manufacturer's catalogue containing the following data

a. Paint Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

b. Technical and performance information that demonstrates compliance with the system performance and material requirements.

c. Manufacturer's Instructions and recommendations on surface preparation, thinning, mixing, handling, applying and proper storage.

d. Colors available for each product (where applicable).

e. Compatibility of shop and field applied coatings (where applicable).

f. Material safety data sheet for each product used.

g. Identification of coating on existing surfaces to be touched up and compatibility with specified coatings.

h. Volatile organic compound (VOC) emission information for each product used.

D. Samples

1. Samples of all paint, finishes, and other coating materials shall be submitted on 8 1/2-inch by 11-inch sheet metal. Each sample shall be completely coated over its entire surface with one protective coating material, type, and color.

2. Two sets of color samples to match each color selected by the CONSTRUCTION MANAGER from the Manufacturer=s standard color sheets. If custom mixed colors are indicated, the color samples shall be made using color formulations prepared to match the color samples furnished by the CONSTRUCTION MANAGER. The color formula shall be shown on the back of each color sample.

3. Qualifications of Painting Subcontractor

   a. Copy of a valid State of California license as required for the application of coatings.

   b. Five references which show that the painting subcontractor has demonstrated successful experience with the indicated coating systems in the recent past. Provide the name, address and telephone number of the owner of each installation. The DESIGN-BUILDER shall obtain the references from the subcontractor and submit them to the CONSTRUCTION MANAGER.

1.6 SERVICES OF MANUFACTURER

A. For submerged and severe service coating systems, the DESIGN-BUILDER shall require the paint manufacturer to furnish the following services:

1. The manufacturer's representative shall furnish at least 6 hours of on-site instruction in the proper surface preparation, use, mixing, application and curing of the coating systems.

2. The manufacturer's representative shall personally observe the start of surface preparation, mixing, and application of the coating materials.

3. The manufacturer's representative shall provide technical support to resolve field problems associated with manufacturer's products furnished under this Contract or the application thereof.

4. The manufacturer shall certify that these services have been furnished, and the DESIGN-BUILDER shall submit the certification within 7 days of completion of each paint system.

1.7 INSPECTION AND TESTING

A. **General:** The DESIGN-BUILDER shall give the CONSTRUCTION MANAGER a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the CONSTRUCTION MANAGER, unless the CONSTRUCTION MANAGER has granted prior approval to perform such work in its absence.

C. Inspection by the CONSTRUCTION MANAGER, or the waiver of inspection of any particular portion of the work, shall not relieve the DESIGN-BUILDER of its responsibility to perform the work in accordance with these Specifications.

D. Scaffolding shall be erected and moved to locations where requested by the CONSTRUCTION MANAGER to facilitate inspection. Additional illumination shall be furnished to cover all areas to be inspected.

E. **Inspection Devices:** The DESIGN-BUILDER shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the CONSTRUCTION MANAGER'S use at all times while coating is being done, until final acceptance of such coatings. The DESIGN-BUILDER shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the CONSTRUCTION MANAGER.

F. **Holiday Testing:** The DESIGN-BUILDER shall holiday test all coated ferrous surfaces inside a steel reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested. In addition to the above the CONSTRUCTION MANAGER may test any surfaces for any number of times at no additional cost to DESIGN-BUILDER. All defects so found shall be corrected by the DESIGN-BUILDER at no additional cost to the OWNER.

1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the indicated coating thickness.

2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

G. **Film Thickness Testing:** On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

H. **Surface Preparation:** Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70 and TM-01-75.

1.8 WARRANTY INSPECTION

A. A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. The DESIGN-BUILDER and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the OWNER. The OWNER may, by written notice to the DESIGN-BUILDER, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the DESIGN-BUILDER shall not be relieved of its responsibilities under the Contract Documents.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

B. Paint materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from deleterious elements.

1.10 EMISSION OF VOLATILE ORGANIC COMPOUNDS (VOCs)

A. The release of VOCs is regulated by the San Diego Air Pollution Control District (SDAPCD). The DESIGN-BUILDER shall maintain daily records of the use of these materials including paint, solvents, thinners, sealants, adhesives, caulking, etc. Any delay or cost that occurs from the administration of SDAPCD regulations is the sole responsibility of the DESIGN-BUILDER and not reimbursable by the City.

B. All coatings, solvents, equipment and procedures necessary to complete the WORK specified in the Contract Documents shall be suitable for corrosive environments and shall conform to all current SDAPCD rules and regulations. Emissions from the coating systems shall be limited to the minimum commercially available product at the time of construction.

C. Materials shall be delivered unopened to the jobsite in their original containers bearing the manufacturer's label, completely identifying the contents, date of manufacture, VOC information as required by the SDAPCD, and listing directions for their proper use.

D. No products shall be allowed onsite that do not conform with SDAPCD rules and regulations. Materials exceeding the storage life recommended by the manufacturer shall be removed from the jobsite.

E. Reports required by the SDAPCD shall be prepared and submitted as applicable.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Suitability:** The DESIGN-BUILDER shall use suitable coating materials as recommended by Manufacturer for the intended service.

B. **Compatibility:** In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

C. **Colors:** All colors and shades of colors of all coats of paint shall be as indicated or selected by the CONSTRUCTION MANAGER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the CONSTRUCTION MANAGER or may be custom mixed to match color samples furnished by the CONSTRUCTION MANAGER.

D. Substitute or "Or Equal" Products

To establish equality under Greenbook Section 4-1.6 and the Supplementary Special Provisions, the DESIGN-BUILDER shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the requirements and is equivalent or better than the listed materials in the following properties:

a. Quality

b. Durability

c. Resistance to abrasion and physical damage

d. Life expectancy

e. Ability to recoat in future

f. Solids content by volume

g. Dry film thickness per coat

h. Compatibility with other coatings

I. Suitability for the intended service

j. Resistance to chemical attack

k. Temperature limitations in service and during application

l. Type and quality of recommended undercoats and topcoats

m. Ease of application

n. Ease of repairing damaged areas

o. Stability of colors

E. Protective coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the DESIGN-BUILDER shall provide the name of least one successfully performing application of the proposed manufacturer=s products in a project of comparable size and complexity constructed in the recent past.

F. The cost of all testing and analyzing proposed substitute materials that may be required by the CONSTRUCTION MANAGER shall be paid by the DESIGN-BUILDER at no additional cost to the OWNER. If the proposed substitution requires changes in the contract work, the DESIGN-BUILDER shall bear all such costs involved and the costs of allied trades affected by the substitution at no additional cost to the OWNER.

2.2 INDUSTRIAL COATING SYSTEMS

A. The VOC limit for any industrial coating system shall not exceed 100 grams of VOC per liter of coating, less water and less exempt compounds.

B. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials shall be considered as indicated above. All industrial coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, water, and wastewater treatment plants.

1. Ameron

2. Carboline Coatings Company

3. Tnemec Company

C. System 1 - Alkyd Enamel: Not Used.

D. System 2 - Not Used.

E. System 3 - Aluminum Silicone Resin: Not Used.

F. System 4 - Aliphatic Polyurethane: Two component aliphatic acrylic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent by volume. Primer shall be a rust inhibitive two component epoxy coating with a minimum solids content of 68 percent by volume.

1. Prime coat (DFT = 4 mils), Amercoat 68HS VOC, Carboline Carboguard 890N, Tnemec Pota-pok Plus Series L140, or equal.

2. Finish coat (one or more, DFT = 3 mils), Amershield VOC, Carboline Carbothane 133MC, Tnemec Endura-shield Series 1081, or equal.

3. Total system DFT = 7 mils.

4. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

G. System 5 - Inorganic Zinc/Polyurethane: Not Used.

H. System 6 - Inorganic Zinc, Water Based: Not Used.

I. System 7 - Acrylic Latex: Single component, water based acrylic latex with a fungicide additive shall have a minimum solids content of 35 percent by volume. Prime coat shall be as recommended by manufacturer. The coating material shall be available in the ANSI safety colors.

1. Prime coat (DFT = 2 mils), or as recommended by manufacturer.
2. Finish coats (2 or more, DFT = 6 mils), Ameron Amercoat 220, Carboline Carbocrylic 3359 DTM, Tnemec Series 1028 or 1029, or equal.

3. Total system DFT = 8 mils.

J. System 8 - Epoxy Equipment: Two component, rust inhibitive polyamide cured epoxy coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 66 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning

1. Prime coat DFT = 3 mils, Amerlock 2/400 series, Tnemec Series V69, or equal.

2. Prime coat, where shop applied. (DFT = 3 mils), universal primer, Ameron 185 HS, Tnemec 50-330 or 161, or equal.

3. Finish coat (2 or more, DFT =6 mils), Amerlock 2/400 series, Tnemec Series V69, or equal.

4. Total system DFT = 9 mils.

K. System 9 - Inorganic Zinc/Epoxy, Equipment: Not Used.

L. System 10 - Acrylic, Concrete: Not Used.

M. System 11 - Aliphatic Polyurethane, Concrete: Two component aliphatic polyester polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering, and with a minimum solids content of 65 percent by volume. Filler-sealer compound shall be a two component epoxy material used to provide a smooth surface for the epoxy intermediate coat. The filler-sealer shall be applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or squeegee. The intermediate coat shall be a high-build epoxy coating with a minimum solids content of 70 percent by volume.

1. Prime coat (Filler-sealer), Ameron Nu-Klad 105A followed by, Nu-Klad 114 Tnemec 54-660, or equal.

2. Intermediate coat (DFT = 4 mils), Ameron Amerlock 400, Tnemec 104 HS, or equal.

3. Finish coats (2 or more, DFT = 3 mils), Ameron Amershield, Tnemec 74, or equal.

N. System 12 - Aliphatic Polyurethane, Fiber Glass: Not Used.

2.3 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. Materials Sources: The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products shall be considered as indicated above.

B. System 100 - Amine Cured Epoxy: High build, amine cured, straight epoxy resin shall have a solids content of at least 80 percent by volume, and shall be suitable for long-term immersion service in potable water and wastewater.

1. Prime coat and finish coats (3 or more, DFT = 16 mils), Tnemec Series 435, or equal.

2. For coating of valves and non-submerged equipment, DFT = 12 mils.

C. System 101 - Cold-Applied Tape: Not Used.

D. System 102 - Polyamide Cured Epoxy: Not Used.

E. System 103 - Coal Tar Epoxy: Not Used.

F. System 104 - Not Used.

G. System 105 - Epoxy, Reservoirs: Not Used.

H. System 106 - Fusion Bonded Epoxy: Not Used.

I. System 107 - Chemical Resistant Sheet Lining: Not Used.

J. System 108 - Epoxy, Concrete: The coating material shall be an amino cured epoxy material suitable for long-term immersion in water and wastewater and for service where subjected to occasional splash and spillage of water and wastewater treatment chemicals. The finish coating material shall have a minimum solids content of 69 percent by volume.

1. Filler-sealer: DFT as recommended by coating manufacturer; Tnemec Series 218 or equal.

2. Finish coats (two or more, DFT = 12 mils); Tnemec Series 435 or equal; On walking surfaces use a non-skid additive per manufacturer's recommendation.

K. System 109 - Not Used.

L. System 110 - Not Used.

M. System 111 - Vinyl Ester: Not Used.

N. System 112 - Vinyl Ester, Concrete: Not Used.

2.4 SPECIAL COATING SYSTEMS

A. System 200 - PVC Tape: Not Used.

B. System 201 - Rich Portland Cement Mortar: Not Used.

C. System 203 - Epoxy Surfacing: Not Used.

D. System 204 - Water-Retardant: Not Used.

E. System 205 - Polyethylene Encasement: Not Used.

F. System 206 - Cement Mortar Coating: Not Used.

G. System 207 - Not Used.

H. System 208 - Aluminum Metal Isolation: Not Used.

I. System 209 - Alkyd-Wood: Not Used.

J. System 210 - Acrylic-Wood: Not Used.

K. System 211 - Acrylic Drywall: Not Used.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on all WORK.

B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

C. All damage to surface resulting from the WORK shall be cleaned, repaired, and refinished to original condition.

3.2 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.3 PREPARATION FOR COATING

A. General: All surfaces to receive protective coatings shall be cleaned as indicated prior to application of coatings. The DESIGN-BUILDER shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.

B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

C. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The DESIGN-BUILDER shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces: Cleaning and coating shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.4 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust and paint which cannot be removed by a dull putty knife may remain.

7. Near-White Blast Cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.5 METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as specified in the coating system schedules included at the end of this Section. Where there is a conflict between these specifications and the coating manufacturer's printed recommendations for the intended service, the more stringent degree of cleaning shall apply.

B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grits.

C. Oil, grease, welding fluxes and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 prior to blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the manufacturer's recommendation for the specific coating and service conditions. Abrasive shall not be used unless approved by the CONSTRUCTION MANAGER.

1. Submerged and Severe Service

a. Automated blasting systems shall not be used for surfaces that will be in submerged service but are acceptable for severe service.

b. Abrasives for submerged and severe service coatings shall be clean, hard, sharp cutting crushed: no metallic abrasives shall be used.

2. Other Services

a. Either automated or manual methods of blasting may be used.

b. Abrasives shall be clean, oil-free metallic abrasives, composed of at least 50 percent grit.

F. The DESIGN-BUILDER shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

G. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil/moisture separators which remove at least 95 percent of the contaminants.

H. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or another approved method prior to painting.

I. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

J. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

K. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2, or SSPC-SP3 may be used.

L. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

M. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

3.6 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used, followed by brush-off blast cleaning per SSPC-SP7.

B. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.7 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS, EXCLUDING STEEL RESERVOIR INTERIORS

A. General: All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

B. Abrasive Blast Cleaning: The DESIGN-BUILDER shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings the DESIGN-BUILDER shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

D. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

E. Water Abrasive or Wet Abrasive Blast Cleaning: Where indicated or where job site conditions do not permit dry abrasive blasting for industrial coating systems due to dust or air pollution considerations, water abrasive blasting or wet abrasive blasting may be used. In both methods, paint-compatible corrosion inhibitors shall be used, and coating application shall begin as soon as the surfaces are dry. Water abrasive blasting shall be done using high pressure water with sand injection. In both methods, the equipment used shall be commercially produced equipment with a successful service record. Wet blasting methods shall not be used for submerged and severe service coating systems unless indicated.

3.8 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.

B. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC-SP1 before abrasive blast cleaning.

C. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper.

D. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.

E. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.

3.9 PLASTIC, FIBER GLASS, AND NONFERROUS METALS SURFACE PREPARATION

A. Plastic and fiber glass surfaces shall be sanded or brush off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.

B. Non-ferrous metal surfaces shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7.

C. All surfaces shall be clean and dry prior to coating application.

3.10 ARCHITECTURAL CONCRETE BLOCK MASONRY SURFACE PREPARATION

Not Used

3.11 SHOP COATING REQUIREMENTS

A. Unless indicated otherwise, items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the indicated or approved color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

B. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

C. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. The DESIGN-BUILDER shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

D. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

E. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before topcoated, or less time if recommended by the coating manufacturer.

F. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

G. The DESIGN-BUILDER shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.12 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with "Paint Application Specification No. 1, (SSPC-PA1)," Steel Structures Painting Council.

B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The DESIGN-BUILDER shall schedule such inspection with the CONSTRUCTION MANAGER in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

H. Coatings shall not be applied under the following conditions:

1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.

2. Dust or smoke laden atmosphere.

3. Damp or humid weather.

4. When the substrate or air temperature is less than 5 degrees F above the dewpoint.

5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.

6. When wind conditions are not calm.

I. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables.

J. Steel piping shall be abrasive blast cleaned and primed before installation.

K. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust free.

3.13 CURING OF COATINGS

A. The DESIGN-BUILDER shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the stringent, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

C. **Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures:** Not Used.

3.14 TESTING FOR VOLATILE ORGANIC COMPOUNDS IN POTABLE WATER RESERVOIRS

Not Used

3.15 IDENTIFICATION OF PIPING

A. Identification of piping shall be in accordance with Section 15030, "Piping Identification Systems."

B. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per General Industry Safety Orders, Article 112 and 5194.

3.16 COATING SYSTEM SCHEDULES - FERROUS METALS

A. **Coating System Schedule, Ferrous Metal - Not Galvanized:**

	Item	Surface Prep.	System No.
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC-SP6	(4) aliphatic polyurethane
FM-16	Surfaces of indoor equipment, not submerged.	Commercial blast cleaning SSPC-SP6	(8) epoxy, equipment

B. **Coating System Schedule, Ferrous Metal - Galvanized:** Pretreatment coatings, barrier coatings, or washes shall be applied as recommended by the coating manufacturer. All galvanized surfaces shall be coated.

	Item	Surface Prep.	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC-SP1	(4) aliphatic polyurethane
FMG-6	Surfaces buried or submerged in water or wastewater, including all surfaces lower than two feet above high water level and all surfaces inside enclosed hydraulic structures and vents.	Solvent cleaning SSPC-SP1 followed by brush-off grade blast cleaning SSPC-SP7	(100) amine-cured epoxy

C. **Coating System Schedule, Steel Water Reservoir Interior:**

Not Used.

D. **Coating System Schedule, Steel Digester Floating Covers and Digester Gasholders:**

Not Used.

E. **Coating System Schedule, Interior Surfaces of Welded Steel Tanks:**

Not Used.

3.17 COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBER GLASS

A. Where isolated non-ferrous parts are associated with equipment or piping, the DESIGN-BUILDER shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-SP1	(4) aliphatic polyurethane
NFM-4	Polyvinyl chloride plastic piping, indoors and outdoors, or in structures, not submerged.	Solvent cleaned SSPC-SP1	(7) acrylic latex

3.18 COATING SYSTEM SCHEDULE-CONCRETE

	Item	Surface Prep.	System No.
C-1	All surfaces indoors and outdoors, as indicated.	Per paragraph 3.8	(11) aliphatic polyurethane, concrete
C-2	Submerged in water or wastewater including surfaces up to 2 feet above high water line and down to 2 feet below low water line and all surfaces in an enclosed structure, as shown.	Per Paragraph 3.8	(108) epoxy, concrete

3.19 COATING SYSTEM SCHEDULE-CONCRETE BLOCK MASONRY

Not Used

**** 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, 14, 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 2-5.3.1 of the Supplementary Special Provisions
2. Section 6-8.2.3.1 of the Supplementary Special Provisions
3. Section 05500 Miscellaneous Metalwork
4. Section 09800 Protective Coating
5. Section 11002 Equipment Supports, Grouting and Installation
6. Section 11005 Machine Alignment
7. Section 13300 Instrumentation and Control
8. Section 15000 Piping Components
9. Section 15020 Pipe Supports
10. Section 16030 Electrical Tests
11. Section 16040 Electric Motors
12. 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. Uniform Mechanical Code (UMC)
2. Uniform Plumbing Code (UPC)
3. Uniform Fire Code (UFC)
4. National Electrical Code (NEC)
5. Uniform Building Code (UBC)

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:

1.	ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
2.	ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
3.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
4.	ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys
5.	ANSI B46.1	Surface Texture
6.	ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
7.	ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
8.	ANSI/ASME B31.1	Power Piping
9.	ANSI/AWWA D100	Welded Steel Tanks for Water Storage
10.	AWWA C206	Field Welding of Steel Water Pipe
11.	ASTM A 48	Specification for Gray Iron Castings
12.	ANSI A 58.1	Minimum Design Loads for Buildings and Other Structures
13.	ASTM A 108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
14.	ANSI/NFPA 70	National Electrical Code
15.	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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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. Static and dynamic loads at each anchor point.
5. Anchor bolt requirements and layout.
6. Drawings showing installation and layout details.
7. Shipping weights.
8. Calculations of equipment anchorage forces and anchorage details.
9. Certification that the single manufacturer accepts the indicated unit responsibilities.
10. Parts list with materials of construction by ASTM reference and grade.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL submittal in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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:** In accordance with the requirements of Section 6-8.2 of the Supplementary Special Provisions, 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.

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 11000-1.7 B.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 specified in Section 2-5.3.1 of the Supplementary Special Provisions, 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 DESIGN-BUILDER 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 DESIGN-BUILDER shall not be responsible for salary or salary-related costs of the inspectors. The DESIGN-BUILDER shall comply with the requirements of Section 4-2 of the Supplementary Special Provisions.

B. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 of Sections 6-8.2.1, 6-8.2.2, and 6-8.2.3 of the Supplementary Special Provisions.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserve 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 DESIGN-BUILDER shall investigate the causes of failure and submit a report to the CONSTRUCTION MANAGER, who will subsequently direct the DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER is responsible to the OWNER for performance of all systems as indicated. The DESIGN-BUILDER 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**: Not Used

B. **Field Vibration Analysis**: If so requested by the Construction Manager, 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 Design-Builder shall retain the services of a qualified specialist in vibration analysis. The 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 shall be 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 the UBC for seismic Zone 4, whichever is greater. Unless otherwise indicated, seismic design importance factors shall be in accordance with Table 16-K of the UBC. Determination of seismic forces and load combinations shall follow procedures in the UBC.

2.3 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. **Equipment Supports:** Equipment supports, anchors, and restrainers shall be designed for static, dynamic, 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 UBC for seismic Zone 4. Unless otherwise indicated, seismic design importance factors shall be in accordance with Table 16-K of the UBC. Determination of seismic forces and load combinations shall follow procedures in the UBC.

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. Commercially manufactured appliances, and small package heating and air conditioning equipment shall be furnished with bearings with L-10 life expectancy of not less than 20,000 hours in accordance with ABMA 9 or 11. 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

A. Power drive chains shall be commercial type roller chains complying with ANSI standards and of materials best suited for the process fluid.

B. A chain take-up or tightener shall be provided in every chain drive arrangement.

C. A minimum of one connecting or coupler link shall be provided with each length of roller chain.

2.11 SPROCKETS

A. **General:** Sprockets shall be used in conjunction with chain drives and chain-type material handling equipment.

B. **Materials:** Except as otherwise indicated, sprockets shall comply with the following:

1. Sprockets with 25 teeth or less, normally used as a driver, shall be medium carbon steel in the 0.40 to 0.45 percent carbon range.

2. Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be minimum 0.20 percent carbon steel.

3. Large diameter sprockets with Type C hub shall be cast iron conforming to ASTM A 48, Class 30.

C. Sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.

D. Finish bored sprockets shall be provided complete with keyseat and set screws.

E. Sprockets shall be of the split type or shall be provided with taper-lock bushings.

F. Idler sprockets shall be provided with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with set screws in both sides of the hub shall be provided.

2.12 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.

B. Sheaves shall be machined from gray cast iron.

C. Sheaves shall be statically balanced. In applications where excessive vibration is expected, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm shall be of materials and construction recommended by the manufacturer.

D. Sheaves shall be provided complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be provided complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

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 DESIGN-BUILDER 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 DESIGN-BUILDER shall retain the services of a firm specializing in this type of work to perform the setting and alignment work. The DESIGN-BUILDER 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 under Section 6-8.2 of the Supplementary Special Provisions. Alignment techniques shall conform to the requirements of Section 11005.

C. **Lubricants:** The DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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

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 in accordance with Section 09800. 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 DESIGN-BUILDER shall provide all supports, anchorage, and mounting of all equipment, unless otherwise specified in accordance with the manufacturer's 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 DESIGN-BUILDER shall provide all elements required to resist the calculated forces described herein or required by the equipment manufacturer. The DESIGN-BUILDER 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 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 Surfacings.
ASTM C579	Compressive Strength of (Method/B) Chemical Resistant Mortars and Monolithic Surfacings.
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 in accordance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 manufacturer's 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 DESIGN-BUILDER 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 MWWD 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 in accordance with the requirements for bleeding surfaces specified in Section 09800 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 x 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 overlayed 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 x 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.

B. Adhesive anchors, where indicated, shall be as specified in paragraph 05500-2.2 B.

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 the 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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.

3. Installation of adhesive anchors shall be in accordance with paragraph 05500-3.1 and 05500-3.2 B.

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 cover 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**

8. 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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. Machinist's 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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 11397 - CENTRIFUGES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing sludge dewatering solid bowl, scroll type centrifuges complete with vibration isolators, drive motor, backdrive system, belt guard, lubrication system, electrical components, electrical control panel and all necessary components, complete and operable. The assembly shall be configured to fit within the constraints of space available.

B. The WORK also includes coordination of design, assembly, testing and installation.

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 09800 Protective Coating
2. Section 11000 Equipment General Provisions
3. Section 11002 Equipment Supports, Grouting and Installation

1.3 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions and paragraph 11000-1.5. A:

1. Manufacturer's product data including catalog cuts.
2. Shipping weights, lifting points for all equipment and special handling instructions.
3. Parts list with materials of construction by ASTM reference and grade.
4. Equipment name, identification number and specification numbers.
5. Shop drawings showing details, dimensions, anchorage details, and installation and layout details of equipment with all special fittings, appurtenances and required clearances.
6. Sizes and locations of external connections such as sludge feed, cake discharge, centrate discharge and polymer feed.
7. Static and dynamic loads at each anchor point.
8. Calculations of equipment anchorage forces and anchorage details.
9. Anchor bolt requirements and layout.
10. Electrical details including horsepower.
11. Logic and control system diagrams, and sequence of operations including a list of functions monitored, controlled and alarmed.
12. Certification that the single manufacturer accepts the indicated unit responsibilities.

1.4 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: An authorized representative of the manufacturer shall visit the site and witness the following for not less than 15 days in three separate trips (each centrifuge) to the job site scheduled with the approval of the CONSTRUCTION MANAGER.

1. Installation of the equipment including alignment and leveling.
2. Inspection, checking, and adjusting the equipment.
3. Startup and field-testing using sludge to verify performance.
4. Performing field adjustments to ensure that the equipment installation and operation comply with the Specifications.

Items 3 and 4 shall be completed no later than 30 days following installation and adjustment of equipment. The DESIGN-BUILDER, in the presence of the manufacturer's service representative, shall then perform the indicated field tests and adjustments to the satisfaction of the CONSTRUCTION MANAGER. After satisfactory conclusion of the testing, the manufacturer shall issue a written statement that the centrifuges satisfy all indicated criteria, and the service warranty shall start from that date.

B. **Instruction of OWNER'S Personnel**: The authorized service representative shall also instruct the OWNER'S personnel in classroom and field settings in the operation and maintenance of the equipment, including step-by-step troubleshooting procedures with necessary test equipment. Instruction of OWNER'S personnel shall be in accordance with Section 2-5.3.8 of the Supplementary Special Provisions.

C. The manufacturer shall submit a written training program to the CONSTRUCTION MANAGER for approval, in accordance with Section 2-5.3.8 of the Supplementary Special Provisions.

PART 2 -- PRODUCTS

2.1 GENERAL

A. General: The DESIGN-BUILDER shall provide the equipment indicated herein. The equipment shall be fabricated, erected, assembled and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. The centrifuge(s) shall be designed for the following conditions:

1.	Feed rate	-400 gpm
2.	Type of sludge	-Approximately 70% digested sludge from an advanced primary treatment plant and 30% primary sludge from a conventional activated sludge treatment plant.
3.	Feed solids concentration	-2.3% average, 3.0% maximum
4.	Operation	-up to 24 hours/day
5.	Minimum G-force	-2500 G
6.	Polymer	-Mannich

B. The centrifuge(s) shall achieve the following performance:

1.	Minimum solids capture	95% of the sludge feed total suspended solids
2.	Minimum sludge cake conc.	-28 percent
3.	Solids loading	-Maximum of 4,600 lb/hr

2.3 MATERIALS

A. **Bowl:** The bowl shall be manufactured from centrifugal castings of type 316, 317 or duplex stainless steel, and designed to operate at a maximum of 3,200 G at the inside bowl wall diameter for maximum process flexibility and reliability and to withstand all centrifugal forces encountered at design operating speeds with adequate safety factors. Rolled and welded or static cast bowls shall not be allowed. The bowl shall be inspected for cracks, shrinkage, porosity, or other defects.

Nominal bowl thickness of the cylindrical and conical sections shall be a minimum of 0.78 inches. The front and rear bowl hubs shall have a minimum nominal thickness of 3.18 inches and 2.25 inches respectively. The centrifuge bowl shall be supported by roller bearings mounted in pillow blocks and fitted for convenient external lubrication. Main bearings shall have a calculated life of at least 100,000 hours at standard operating speeds in accordance with DIN ISO 281 requirements.

Flow through the centrifuge shall be counter current such that there are no centrate tubes to maintain. Pool depth shall be readily adjustable via centrate discharge power plates located at the large diameter end of the bowl that do not require removing the rotating assembly from the frame. Solids shall be discharged at the small diameter end of the bowl.

B. **Scroll:** Each centrifuge shall include a stainless steel of type 316, 317 or duplex stainless steel horizontal conical-cylindrical scroll conveyor equipped with helical flights independently mounted concentrically within the bowl. The scroll shall utilize a differential speed to convey solids from the cylindrical section to the conical section and out of the bowl with a minimum disturbance to the pool, and to the maximum advantage of the variable speed backdrive described in this section. The scroll conveyor shall be supported on grease lubricated anti-friction ball or roller bearings sealed from process contamination.

The edge and the face of the conveyor flights shall be protected by a series of welded on sintered tungsten carbide tiles, as described in the abrasion protection section. The tiles shall extend from the feed zone area to the point of solids discharge.

The scroll conveyor shall be designed such that the feed leaving the feed tube is accelerated in a feed zone. The feed material leaving the conveyor hub will pass through tungsten carbide hardsurfaced feed nozzles. The feed shall be evenly discharged into the bowl. The flights on the conveyor shall be designed with flow equalization windows to allow axial flow of centrate for minimum disturbance to the pool and maximum settling of fine particles.

C. **Bearings:** The centrifuge bowl shall be supported by roller bearings mounted in pillow blocks and fitted for convenient external lubrication. Main bearings shall have a calculated life of at least 100,000 hours at standard operating speeds in accordance with DIN ISO 281 requirements.

D. Abrasion Protection

1. In order to minimize wear due to abrasive materials in the feed, replaceable hard surfacing shall be provided at all points where the abrasive action of the sludge will cause wear on the metal parts of the centrifuge. The following shall be considered a minimum degree of hard surfacing required.

   a. Bowl Wall: The bowl wall and conical extensions shall be protected with minimum of eight (8) welded ribs designed to trap a protective layer of solids between the bowl wall and the conveyor.

   b. Conveyor Feed Ports: The conveyor feed ports shall be protected from abrasion by field replaceable solid sintered tungsten carbide elements.

   c. Solids Discharge Ports: The solids discharge ports shall be protected from abrasion by field replaceable tungsten carbide wear saddles.

   d. Solids Discharge Casing: a replaceable stainless steel or urethane insert shall protect the solids discharge casing.

   e. Scroll Conveyor Flights: The edge and face of the conveyor flights shall be protected against abrasion from the solids by a series of welded-on sintered tungsten carbide tile assemblies from two wraps beyond the feed zone through the solids discharge end. Each tile assembly shall be weight correct, and consist of a solid sintered tungsten carbide wear part braised to a stainless steel back-up holder. Spray hardsurfacing applied to a back-up plate will not be allowed. Each assembly shall be individually replaceable and shall include the ability to monitor wear by means of visual inspection. The tile assemblies must extend 0.75 inches beyond the radial edge of the conveyor flight. The remaining scroll conveyor edge and face shall be protected from abrasion by flame sprayed hardsurfacing containing a minimum 40% tungsten carbide particle. Stellite or ceramic hardsurfaced tiles shall not be acceptable.

E. Lubrication

The main bearings on the centrifuge shall be lubricated by a forced feed oil system. The system shall consist of a reservoir oil pump with electric motor, flow switches, heat exchanger sized to cool the lubrication oil, temperature indicators and flow controls. The oil reservoir shall have a drain valve. The bearings on the scroll conveyor shall be grease lubricated through fittings located on the exterior of the rotor.

Bearing temperature monitors will be provided on each main bearing pillow block, with an analog output signal sent to the DMS for display and monitoring at the HMI operator interface. The gearbox lubrication shall be self-contained and consist of high performance gear oil.

F. Main Drive Motor:

1. The motor shall be a squirrel cage induction motor suitable for VFD starting, 200 HP, 1800 rpm, TEFC, continuous duty, with a non-hydroscopic class F insulation system limited to a B temperature rise, 1.0 service factor on sine wave, NEMA design B or IEC equivalent design, standard long shaft for v-belt drive, and terminal box rotatable in 180 degree increments. The motor shall be provided with thermal protection using a bi-metal thermal switch. The motor shall have copper windings and be of high thermal capacity design for operation on 460/3/60 power. Fluid coupling/clutch starting systems shall not be allowed due to maintenance concerns.

2. With the motor at ambient temperature, it shall be capable of making (2) complete starts in succession with coasting to rest between starts. The motor shall be capable of one (1) immediate restart after any shutdown except motor overload. The motor shall not take longer than five minutes (each start) to accelerate to full rated rpm at 90% nameplate voltage while maintaining operation below name plated full load amps. The motor shall be rated by the motor manufacturer as having a noise level not exceeding 85 dBa (sound pressure) when measured at three (3) feet from the motor in any direction. The motor bearings shall be grease lubricated, ball or roller anti-friction type of standard manufacture. The bearings shall be conservatively designed to withstand all stresses of the service specified. Motor bearings shall have a minimum life rating of 40,000 hours of operation.

3. Space heaters (120 V) shall be provided for main drive motors, in accordance with Specification 16040 paragraph 2.2 P.

4. Motor shall be Baldor or approved equal.

G. Backdrive System:

1. Each centrifuge shall be furnished with a complete back drive system to control differential speed between the conveyor and the bowl. The backdrive shall provide an infinitely adjustable differential speed variation over its range of operation.

2. The backdrive motor shall be a 50 HP premium efficiency squirrel cage induction motor for VFD duty, TEBC, blower cooled, continuous duty, 1.0 service factor, NEMA design B, with class F insulation and class B rise, and a pinion pickup sensor for pinion speed feedback control. The motor shall have copper windings and be designed for operation on 460/3/60 power and balanced for centrifuge operation. Thermal protection in the motor shall be bi-metallic thermostat. The VFD system shall be sized in accordance with the centrifuge manufacturer's design requirements. The motor shall be capable of delivering full load torque across a 20:1 turn down ratio. The drive system shall be capable of a flying restart.

3. Each back drive system shall be furnished with all the required instrumentation and electrical controls to meet the operating requirements of this specification.

4. Space heaters (120 V) shall be provided for backdrive motors, in accordance with Specification 16040 paragraph 2.2 P.

5. Back drives utilizing hydraulic drive, or water cooled units will not be acceptable.

H. Vibration Isolation: The centrifuge shall have restrained spring type or rubber type vibration isolators upon which it shall be mounted. Flexible connectors shall be provided for all pipelines leading to and from the centrifuge and the centrate and sludge cake discharge chutes.

I. Frame and Casings

1. The rotating assembly and bearings of the centrifuge shall rest on a steel frame.

2. The frame and casing shall be supplied on a modular frame and shall be fabricated from structural tubular steel. The modular frame shall support both the drive motor and backdrive and shall provide a minimum clearance of 6.75 inches from floor to the casing solids and liquid discharge openings. The casing assembly will be provided with a 316 stainless steel upper casing, specifically designed for rigidity and noise reduction. Fiberglass upper casing shall not be allowed. The case shall be designed to act as a protective guard and to provide a complete enclosure for odor containment. The casing top shall be gasketed.

3. The bottom of the casing shall be fitted with a flexible splashguard for cake discharge. The liquid discharge shall be fitted with a flexible connection fitted with a flanged connection for the centrate. The lower casing shall be fabricated from carbon steel with stainless steel cladding on the wetted parts.

4. The case top shall be hinged (left or right sided) or removable bolted in place, and be equipped with a cover switch so the centrifuge cannot be started when the cover is open.

5. Vibration isolators for the drive motor and back drive shall be supplied as required by the manufacturer. Conduit boxes for all centrifuge mounted switches, except those specifically related to the main drive motor, shall be mounted on the base.

J. Protective Coatings: The exterior of all metallic centrifuge equipment shall be shop-coated with an epoxy primer coat and a top coat of aliphatic polyurethane or as recommended by the manufacturer for the service conditions anticipated at the location of the WORK. The total dry film thickness shall not be less than 7 mils. Protective coatings for other equipment and non-metallic exterior surfaces shall be in accordance with Section 09800.

2.4 ELECTRICAL COMPONENTS

A. All electrical components shall be mounted in a stainless steel panel with NEMA rating in accordance with the area designations of Section 16050. The panel and all electrical components shall be UL listed.

B. The panel shall contain motor starters for the main drive, backdrive, and oil pump motors. Terminals shall be provided for incoming power connections. A ground lug shall be supplied on the panel.

C. **Controls**: The panel shall include a Programmable Logic Controller (PLC). Controls shall provide for single point startup, shutdown and restart, including permissive signals for start/stop of feed systems, sludge conveyance, polymer feed system, and flushing water. Automatic centrifuge shutdown and feed pump shutdown shall be interlocked with appropriate malfunction alarms. Manual startup controls shall also be provided. An interface for remote control shall also be provided.

In the event of a power shutdown, the control system shall be capable of allowing the centrifuge to be brought to a stop in normal shutdown mode, including a normal flush cycle with differential speed during the coast down period. The system shall allow the centrifuge to scroll out solids and be available for immediate restart once the power is restored.

D. **Monitoring/Alarms**: A monitoring system shall be provided to detect and indicate centrifuge malfunctions. The monitoring system shall be capable of providing an alert condition and shutting down the feed and polymer pumps in the event of the following conditions:

1. Feed pump fault
2. High vibration alert
3. Bearing high temperature alert
4. High motor temperature alert (main drive motor and backdrive motor)
5. High scroll torque alert
6. Sludge cake conveyor malfunction (indicated by zero speed switch on conveyor)
7. Lubrication oil reservoir low level alert

When a malfunction occurs, the machine shall be shut down, and polymer and sludge feed systems shut off as appropriate, and an alarm light indicating the nature of the malfunction shall be illuminated. Alarms provided shall include:

1. Lubrication oil high temperature and low pressure
2. Excessive vibration alarm
3. Bearing high temperature alarm
4. Motor overhead (main drive motor and backdrive motor)
5. High scroll torque alarm
6. Main drive or backdrive malfunction
7. Centrifuge bowl overspeed

E. **Monitoring/Display**: The control system shall monitor and display the following information:

1. Bowl speed
2. Scroll speed
3. Differential speed
4. Scroll torque
5. Drive motor amps
6. Backdrive motor amps
7. Main bearing vibration acceleration
8. Sludge feed flow rate
9. Polymer feed flow rate
10. KWH meter and totalizer for total centrifuge system
11. Lubricating oil temperature
12. Bearing temperature

2.5 SHOP INSPECTION/SHOP TESTING

A. The CONSTRUCTION MANAGER and the OWNER shall have the option of inspecting the centrifuge system equipment at the factory during the fabrication process.

B. Shop testing of the equipment shall be defined as operation of the centrifuge with its electrical panel, while feeding potable water to the machine. The purpose of the shop test shall be to test mechanical and electrical systems, and make necessary adjustments or repairs prior to shipment. If the machine is to be stored at the manufacturer's factory, the shop test shall be successfully completed prior to storage. The centrifuge system shall not be shipped until it has successfully been shop tested.

C. The CONSTRUCTION MANAGER and OWNER shall have the option of sending representatives to witness each shop test. The manufacturer shall provide written notice to the CONSTRUCTION MANAGER at least 15 days prior to the shop test date.

2.6 TOOLS AND SPARE PARTS

A. **Tools**: The DESIGN-BUILDER shall supply one complete set of special tools for adjustment, disassembly, and service of the centrifuge equipment, as follows:

1 Bowl lifting sling
2. Conveyor lifter
3 Universal tools

4. Wrenches and tool box for disassembly
5. Bowl truck
6. Scroll extracting tool
7. Hydraulic bearing puller

B. **Spare Parts**: The following spare parts shall be included for each centrifuge installed:

1. One complete set of O-rings, seals and gaskets
2. One set of main bearings and scroll conveyor bearings
3. One set of main drive belts
4. One revolution of sintered tungsten-carbide tiles (approximately 30 tiles)
5. Two sets of inspection port fasteners
6. Two sets of case cover fasteners
7. One set of weir plate fasteners
8. One vibration sensor
9. One main bearing temperature sensor
10. One set of solids discharge port replaceable tungsten-carbide wear plates
11. One set of all flexible connectors
12. One set of replaceable conveyor inlet port liner

C. The DESIGN-BUILDER shall supply all necessary oil and grease for startup and acceptance testing. Sufficient oil and grease shall be provided for one year of operation following acceptance.

2.7 MANUFACTURERS

A. Dewatering centrifuges shall be ALDEC G2-120 manufactured by Alfa Laval, Inc.

PART 3 -- EXECUTION

3.1 GENERAL

A. The installation shall be done in accordance with the manufacturer's written procedures and instructions.

3.2 STARTUP TESTING/ACCEPTANCE

A. The manufacturer shall provide written notice to the CONSTRUCTION MANAGER that the centrifuge system has been properly installed, and is ready for startup.

B. The manufacturer shall be allowed 30 days to start up and fine tune its machine prior to acceptance testing.

C. The acceptance test shall consist of continuous operation of the centrifuge system, with sludge feed, for a period of 48 consecutive hours. The CONSTRUCTION MANAGER will arrange for samples to be collected and analyzed at four-hour intervals as follows:

Sludge Feed	Total Suspended Solids Concentration
	Volatile Suspended Solids Concentration
Centrate	Total Suspended Solids Concentration
Sludge Cake	Total Suspended Solids Concentration

D. Acceptance of the system by the CONSTRUCTION MANAGER is contingent upon all samples meeting or exceeding guaranteed performance parameters during the test period.

**** 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. The DESIGN-BUILDER shall be responsible for the design, procurement, installation, testing, training, and documentation for instrumentation and control systems provided under this Contract. Distributed Control System (DCS) modifications shall be provided by the DESIGN-BUILDER who shall contact Emerson to provide control systems integration. The DESIGN-BUILDER shall be responsible for interfacing with the DCS components, including installing and terminating DCS inputs and outputs (I/O), providing power, and for installing and testing all equipment.

C. Per Section 2-5.3.1 of the Supplementary Special Provisions the DESIGN-BUILDER 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 instruments, panels, valve actuators, MCCs, and the DCS.

D. The DESIGN-BUILDER shall either modify existing or generate new complete loop drawings for each measuring or control loop. The loop drawing shall include a minimum of 3 sheets as required in paragraph 1.5 B.2.

E. All control system field tests including loop tests, plant commissioning, and plant startup, shall be the responsibility of the DESIGN-BUILDER. The DESIGN-BUILDER shall provide competent personnel including electrical engineer, I&C engineer, and process engineer during all field tests. The DESIGN-BUILDER shall be responsible for providing field and control room personnel to witness the simulation of field inputs associated with the DCS I/O. The DESIGN-BUILDER 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).

F. The DESIGN-BUILDER shall perform field engineering design as required for mounting and supporting all field mounted components. The DESIGN-BUILDER shall develop any additional schematic and interconnection diagrams which may be required for complete and operable instrumentation.

G. The DESIGN-BUILDER shall secure the services of an I&C SubCONTRACTOR who acting through the DESIGN-BUILDER 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 I&C SubCONTRACTOR shall employ the services of Emerson to provide a complete, integrated and operable DCS system. The SubCONTRACTOR's role 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 I&C SubCONTRACTOR 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 SubCONTRACTOR shall coordinate between the relevant parties to ensure that the necessary stage of completion is reached by all involved parties and all functional tests have been performed 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. Section 09800 Protective Coating
2. Division 11 Equipment, as applicable
3. Division 15 Mechanical, as applicable
4. Division 16 Electrical, as applicable
5. Section 13400, Distributed Control System (DCS)

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:

1.	ANSI/ASME B 16.5	Pipe Flanges and Flanged Fittings
2.	API RP-550	Manual on Installation of Refinery Instruments and Control Systems, Part 1 - Process Instrumentation and Control Sections 1 Through 13
3.	ASTM A 105	Specification for Forgings, Carbon Steel for Piping Components
4.	ASTM A 193	Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service

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

1.5 SHOP DRAWINGS AND SAMPLES

A. **Presubmittal Conference:**

1. The DESIGN-BUILDER 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 DESIGN-BUILDER intends to carry out his responsibilities for shop drawing submittal on the WORK to be provided under this Section. The DESIGN-BUILDER and the CONSTRUCTION MANAGER shall attend. Both the DESIGN-BUILDER and the CONSTRUCTION MANAGER may invite additional parties at their discretion.

2. The DESIGN-BUILDER shall allot two, 1 4-hour day for the Conference.

3. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER shall furnish 3 copies of all the items above to the CONSTRUCTION MANAGER.

5. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 copies of the preliminary submittal shall be provided for the City's review. Documents shall be in PDF format.

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 copies of the final submittal shall be provided.

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 DESIGN-BUILDER shop drawings developed under the Contract shall be in Bentley Microstation (.DGN) format. Documents in electronic format (WordPerfect, Microsoft Word, Excel, Lotus, 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 DESIGN-BUILDER. The title block shall include, as a minimum, the DESIGN-BUILDER 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 DESIGN-BUILDER shall submit four (4) electronic copies of all current shop drawings.

3. Loop Diagrams: loop diagrams shall be provided in accordance with Section 2-5.3.1 of the Supplementary Special Provisions 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 DESIGN-BUILDERs. 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 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

e. Examples of the current loop drawings for existing centrifuge 2 are included in the contract documents for reference.

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. Shop Drawings of differential pressure producing flow tubes and elements, showing the device's proportions and performance. The DESIGN-BUILDER shall furnish a certified curve from the manufacturer showing flow versus differential pressure for each flow metering device furnished. Where applicable, the following data shall be furnished for each device:

a. Coefficient values and tolerances

b. Effects of upstream configuration

c. Headloss as a function of the velocity head expended

d. Test results from a recognized hydraulic laboratory showing that the discharge coefficient is within 0.75 percent of standard for each meter. Documentation tabulating tests of at least 30 different meters of the same type which show compliance with the two standard deviation tests in ASME "Fluid Meters," Sixth Edition, will be an acceptable alternative.

6. 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.

7. 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.

8. Installation, mounting, and anchoring details for all components and assemblies to be field-mounted, including conduit connection or entry details.

9. 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, handstations, 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 shall comply with the requirements of Section 2-5.3.1 of the Supplementary Special Provisions with the following exceptions:

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 DESIGN-BUILDER with comments.

2. Final copies of the OWNER'S MANUAL, after revision, shall be submitted to the CONSTRUCTION MANAGER 15 days prior to startup.

C. The following shall be included in the OWNER'S MANUAL in accordance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 in accordance with Section 2-5.3.1 of the Supplementary Special Provisions with the following exceptions and changes:

1. The DESIGN-BUILDER 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 flow meters and analyzers.

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 DESIGN-BUILDER shall guarantee the WORK of this section for two years following final acceptance of the WORK. In making any warranty repairs, the DESIGN-BUILDER 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 ENVIRONMENTAL CONDITIONS

A. **General**: All instrumentation and control system components and associated wiring shall be suitable for use in a treatment facility environment where there may be high energy AC fields, DC control pulses, and varying ground potentials between transducers and system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.

B. **Field Situated Equipment**: The instrumentation and control system shall be installed on a wastewater treatment plant site. All devices shall be designed to exist in environments rated (G2)(G3)(GX) per ISA S71.04. The system design shall be adequate to provide proper protection the environment typically associated with these facilities. As a minimum, the instrumentation and control systems shall be designed and constructed for satisfactory operation and low maintenance requirements under the following environmental conditions:

1. Temperature Range: 0 through 50 degrees C (32 through 122 degrees F)

2. Thermal Shock: 0.55 degrees C per minute (1.0 degrees F per minute)

3. Relative Humidity: 20 through 95 percent (non-condensing)

C. **Control Room Situated Equipment**: Control rooms shall be air conditioned to achieve the environmental noted in item B herein. (No positive control of relative humidity is provided.) In the event of a failure of the air conditioning system, all components of the instrumentation and control system shall be rated to operate in an environment where the ambient temperature is 15 through 35 degrees C (59 through 95 degrees F) and the relative humidity is 20 to 95 percent (non-condensing).

D. **Noise Tolerance**: The instrumentation and control system components shall not exceed a db level of 55 when monitored 3-feet away from the devices. If upon testing it is found that this limit is exceeded at the option of the CONSTRUCTION MANAGER and at no additional cost to the OWNER, devices shall be replaced in order to achieve a maximum level of 55 db or sound absorption materials shall be added.

1.12 CABLE NUMBERING

A. The first two characters denote the facility or area number.

B. The second group of characters identifies the device being served (field device, not

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 DESIGN-BUILDER 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. Control panels shall be provided with redundant power supplies which are configured in a fault-tolerant manner to prevent interruption of service upon failure and interruption of service necessitated by the replacement of a power supply. All power supplies shall have an excess rated capacity of 40 percent. The failure of a power supply shall be annunciated locally and shall generate an alarm to the DCS.

I. Each control loop shall be individually fused.

2.2 CONTROL PANELS

A. **General**: Control panels, including those furnished by equipment manufacturers, and shall be provided according to the following requirements.

1. Where indicated, control panels shall be provided with all required taps, fittings, rotameters, regulation and alarm interlocks to enable the implementation of a purge system which is in conformance with ISA-S12.4 Type Z requirements. Dimensions shall be in accordance with manufacturer's requirements. Elevations and horizontal spacing shall be subject to CONSTRUCTION MANAGER'S approval.

2. All control panels which require NEMA 3 or 4 ratings will be provided with window kits to preserve the panel's integrity and enable operations ready access to information.

3. Panels shall be fabricated, piped and wired by fully qualified workmen who are properly trained, experienced and supervised.

4. See Appendix C for control panels to be provided under this Contract.

B. **Materials:**

1. Panel section faces shall be #10 gage minimum thickness steel for free standing panels and #14 gage minimum thickness steel for smaller panels. All materials shall be selected for levelness and smoothness.

2. Relay rack high density type panels shall utilize standard relay racks with 14 gage steel frame and supports.

3. Structural Shapes and Strap Steel: ASTM A 283.

4. Bolting Material: Commercial quality carbon steel bolts, nuts and washers, all ½-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex head machine bolts. All nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have S.A.E. standard lock washers.

C. **Fabrication:**

1. End plates, top plates and top closure panels shall be furnished when required. End plates, top plates and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths which match the widths of standard panels, except that one top closure panel may extend across two 4-feet 6-inches wide or five 2-feet 0-inches wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

2. End closure or rear closure doors shall be provided. Such doors shall be flush fitting and gasketed and be of the hinged lift-off type with lockable door handles. A common key shall be provided for all doors on one panel assembly. Where removable access panels are indicated, they shall be furnished with dished handle fasteners. Screw driver 1/4 turn type fasteners are not acceptable.

   a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.

   b. The face of the panel shall be true and level after flanging.

   c. All panel cut-outs and holes may be cut or drilled by any standard method that will not cause deformation. Burrs shall be ground smooth.

   d. Adjacent panels shall be assembled with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.

   e. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of front of panel mounted instruments.

   f. Panels shall be self-supporting as defined below.

D. **Framework and Supports:**

1. The rear of each panel section shall have a steel framework for supporting conduit, tubing, wireways, switches, air piping and all instrument accessory items such as relay or terminal enclosures, transducers, pressure switches, valves and air relays. The main frame work shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. Framework must not interfere with instrument connections or access needed for maintenance or adjustments.

2. Steel framework shall extend 2-feet 8-inches back of the panel face unless otherwise required. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel shall be self-supporting.

E. **Finish**:

1. Preparation: The front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all openings shall be prepared as follows.

   a. All high spots, burrs, and rough spots shall be ground smooth.

   b. The surfaces shall be sanded or sandblasted to a smooth, clean bright finish.

   c. All traces of oil shall be removed with a solvent.

2. Finishing:

   a. A 3-mils dry coat of Amercoat 185 or equal primer shall be applied over the entire panel surface immediately after solvent cleaning.

   b. Wet sand, dry, then quick glaze spot putty on the front of the panel only. Dry, then wet sand again and dry.

   c. Apply a second 3-mils dry coat of alkyd enamel primer to the front of the panel.

   d. Wet sand to smooth clear finish, then dry.

   e. At least two 3-mil dry coats of air-dry, satin finish, alkyd enamel shall be applied over the entire surface. Color to be as selected by CONSTRUCTION MANAGER.

   f. The DESIGN-BUILDER shall furnish two 1-pint containers of the enamel to the CONSTRUCTION MANAGER.

3. Instrument Finishing:

   a. The final coats applied to painted surface of instrument cases, doors, or bezels which are visible from the front of panels shall be manufacturer's standard unless otherwise indicated. Black japan or "crinkle" finishes on instrument cases are not acceptable

F. **Mounting of Instruments:**

1. The DESIGN-BUILDER shall provide cut-outs, and shall mount all instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other manufacturers.

2. The DESIGN-BUILDER shall also mount, behind the panels, other instrument accessory items as indicated.

3. Rear of panel mounted equipment shall be installed with due regard to commissioning adjustments, servicing requirements and cover removal.

4. Wiring shall be kept clear of spare space to give maximum space for future additions.

G. **Piping Requirements for Control Panels:**

1. General:

   a. The DESIGN-BUILDER shall provide terminal connections near the top, rear of the panel for all tubing and piping which connect to instruments, valves, air supply and other pressure leads external to the panel. Terminal connections for tubing shall be bulkhead tube unions. Those for pipe shall be threaded couplings, plugged for shipping purposes.

   b. Each terminal connection shall have an engraved metal or plastic plate with a terminal and instrument tag number affixed nearby.

   c. The DESIGN-BUILDER shall provide the air supply pressure reducing station, all instrument and supply piping and all pneumatic tubing or piping to terminal connections and between instruments located within the confines of the panel and supporting framework.

2. Air Supply Piping:

   a. The DESIGN-BUILDER shall provide air supply piping from a point near the top of the panel framework to the inlet side of the pressure reducing station, or alternately to the inlet side of individual filter regulators.

   b. Piping, fittings and valves downstream of the filters at the air supply reducing station shall be brass or copper. Headers may be extruded aluminum if the tube wall section is thick enough to accept threaded connections.

   c. The low pressure instrument air supply header shall extend from the down stream side of the main pressure reducing valves across the length of panel which includes air users. Where the header must be broken for shipping purposes, brass unions shall be provided at the panel section junctions.

   d. A separate air supply take-off consisting of a 1/4-inch brass connection braced into the air header (if brass or copper) shall be furnished for each instrument requiring an air supply. An additional 10 percent of the take-offs shall also be provided. Take-offs for 3/4-inch size headers may be made by using 3/4-inch by 3/4-inch by 1/4-inch reducing tees.

e. Each take-off shall be fitted with a 1/4-inch brass diaphragm of needle type shut-off valve. Provide circular type handle with tag number shown thereon.

f. The dead end of the air header opposite the supply end shall be fitted with a plugged ½-inch brass gate valve.

g. The connection from the shut-off valves air head to the instruments shall be by means of 1/4-inch or 3/8-inch O.D. tubing as required

H. **Electrical Requirements for Control Panels**:

1. The DESIGN-BUILDER shall provide all wiring, conduit, wireways, and switches required to make instruments and other panel electrical devices operational.

2. 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.

3. 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.

4. Freestanding panels shall be provided with switched 100-watt incandescent back-of-panel lights which are powered from a source independent from that which powers the panel devices. One light shall be provided for every 4 feet of panel width and shall be mounted inside in the top of the back-of-panel area.

5. Freestanding panels shall be provided with a 15-amp, 120 volt service outlet circuit within the back-of-panel area which are powered from a source independent from that which powers the panel devices. The circuit shall be provided with one 3-wire, 120-volt, 15-ampere, duplex receptacle for every 4 feet of panel width spaced evenly along the back-of-panel area. As a minimum, 2 duplex outlets shall be provided for each panel.

6. Smaller panels shall be sized to adequately dissipate heat generated by equipment mounted in or on the panel.

7. 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.

8. Smaller panels shall be provided with a hand-switch controlled 100-watt incandescent light and a breaker protected 120-volt, 15-amp duplex receptacle.

9. 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.

10. Construction:

a. 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.

b. Flexible conduit is not acceptable.

c. Conduit fittings shall be cast fittings.

d. Soldered or pressure crimped wire splicing in conduits shall be acceptable.

e. 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 DESIGN-BUILDER shall connect the copper cable to a system ground loop.

f. 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.

g. 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.

11. Power Supply Wiring:

a. Unless otherwise indicated, all instruments, all alarm systems, and all motor controls shall operate on 24 VDC circuits.

b. The DESIGN-BUILDER shall furnish terminal box connections for the main power supply entry as indicated.

c. Power supply switches for alarm units shall be three pole type, arranged to open both the power and alarm circuits. Each annunciator shall be equipped with a separate switch.

d. 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 fuseholder, with each fuse identified by a service name tag.

e. 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.

f. 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.

12. Alarm Wiring: The DESIGN-BUILDER shall provide all alarms including light cabinets, audible signal units, test and acknowledge switches and remote logic units as indicated. Interconnecting wiring to panel mounted initiating devices shall also be provided. Wiring from external initiating devices shall be provided by the DESIGN-BUILDER. Where plug and cord sets are provided for component interconnection, the DESIGN-BUILDER shall harness and support the cables in a neat and orderly fashion. Where separate wire is required, the DESIGN-BUILDER shall install 16 AWG with THWN or THHN insulation between all components.

13. 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.

14. Thermocouple Wiring:

    a. The DESIGN-BUILDER shall provide metal wire troughs, pullboxes, and thin walled conduit for duplex thermocouple lead wire in a manner which will facilitate field installation of lead wire without splices or terminal connections. The DESIGN-BUILDER shall also provide the lead wire connections between multipoint temperature sensors and temperature indicators when indicated. When a thermocouple junction box is indicated, it shall be located with the approval of the CONSTRUCTION MANAGER. The panel manufacturer shall install conduit and troughs and lead wires between the junction box and the instruments. Terminal material shall be compatible with extension wire used.

    b. Thermocouple lead wire shall be No. 16 AWG with high temperature PVC insulation on each wire and PVC jacket overall, and shall conform to the latest ISA Specification for standard grade.

c. Conduit for thermocouple lead wire shall be in accordance with the following:

CONDUIT SIZE	½"	3/4"	1"	1½"	2"
NO. OF DUPLEX LEADS	1	4	6	16	26

d. Where the number of duplex lead wires exceeds 26, the wires shall be installed in rectangular ducts filled to not more than 40 percent capacity.

e. All thermocouple wireways and main conduits shall be sized to allow for 10% spare thermocouple leads.

f. Each signal, control, alarm, and indicating circuit conductor shall be designated by a single unique number which shall be shown on shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be plastic-coated cloth, or shall be permanently marked heat-shrink plastic.

15. 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.

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 DESIGN-BUILDER 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. DESIGN-BUILDER shall perform the following tests prior to arrival of the CONSTRUCTION MANAGER:

   a. All air lines adequately tested for leaks.

   b. All alarm circuits rung out to determine their operability.

   c. Electrical circuits checked for continuity and where applicable, operability.

   d. Nameplates checked for correct spelling and correct size of letters.

   e. Other test required to place the panel in an operating condition.

3. It shall be the responsibility of the DESIGN-BUILDER 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 DESIGN-BUILDER shall reimburse the OWNER for the cost of the extra time required for the inspector's services and travel expenses

L. **Shipment:**

1. 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

2.3 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.

D. **Slave Relays:** Slave relays shall be provided when the number or type of contacts indicated exceed the contact capacity of the indicated relays and timers.

E. **Circuit Breakers:** Circuit breakers shall be single pole, 120-volt, 15 ampere rating or as required to protect wiring and equipment. Circuit breakers shall be mounted inside the panels as shown.

2.4 FLOW MEASURING SYSTEMS

A. **Magnetic Flow Measuring Systems:** Magnetic flowmeter systems shall be of the low frequency electromagnetic induction type and produce a 4 - 20 mA DC signal directly proportional to and linear with the liquid flowrate. Complete zero stability shall be an inherent characteristic of the flowmeter system. Each magnetic flow metering system shall include a metering tube, signal cable, transmitter and flowmeter grounding rings.

1. The metering tube shall have the following attributes:

    a. constructed of 304 or 316 stainless steel with flanged connections

    b. utilize a minimum of 2 bullet-nosed, self-cleaning electrodes

    c. liner in conformance with the manufacturer's recommendation for the meters intended service

    d. electrodes constructed of materials which are in conformance with the manufacturer's recommendation for the meters intended service

    e. meter housing rated for NEMA 6 submergence conditions

    f. meter coating consisting of epoxy painted finish

    g. two grounding rings which are in conformance with the manufacturer's bore and material recommendation for the meters intended service. Grounding rings shall be designed to protect and shield from process abrasion the liners edge interface at the meters end:

2. The microprocessor-based signal converter/transmitter shall have the following attributes:

a. utilize DC pulse technique to drive flux-producing coils

b. convert DC pulse signal from the tube to a standardized 4-20 mA signal into a minimum of 700 ohms

c. 6 digit LCD display for flow rate, percent of span, and totalizer

d. an operator interface consisting of keypads which respond to English text entry

e. integral zero return to provide a consistent zero output signal in response to an external dry contact closure

f. integral low flow cutoff and zero return

g. automatic range change

h. capable of measuring flow in both directions

i. programmable parameters including meter size, full scale Q, magnetic field frequency, primarily constant, time constant

j. data retention for a minimum of 5 years without auxiliary power (main or battery)

k. self diagnostics and automatic data checking

l. protected terminals and fuses in a separate compartment which isolates field connection from electronics

m. utilize "Smart" technology which employs a hand-held configuration terminal and outputs a digital flow signal superimposed on 4-20 mA signal and complies to protocol which is ungradable to SP 50.

n. produces a scalable frequency output, 0 to 100 Hz, transistor switch closure up to 5.75 W externally powered, 5, to 24 VDC.

o. can tolerate ambient temperature operating limits of -20 to 140 degrees F (-29 to 60 degrees C).

3. Each flow metering system shall be hydraulically calibrated at a facility which is traceable to the National Institute of Standards and Technology. The calibrations procedure shall conform to the requirements of MIL-STD-45662A. A real-time computer generated printout of the actual calibration data indicating apparent and actual flows at 20%, 40%, 60%, 80% and 100% of the calibrated range shall be submitted to the Construction Manager at least thirty (30) days prior to shipment of the meters to the project site. The flow metering system shall conform to the following technical specifications: Time constant = 0.5 to 1000 seconds; galvanic or optic isolation: Accuracy: 0.25 of flow rate from 10 to 100% full scale for velocities over 3 FPS: Repeatability: 0.25% full Scale: Power consumption: 30 watts or less: Power Requirements: 120 VAC, ± 10% (24 VDC).

4. See Appendix C for a schedule of required devices for this Contract.

5. Magmeters shall be Krohne America to match existing.

2.5 CONTROL PANEL INSTRUMENTATION

A. **Bar Graph Indicators**: Indicators shall be the electronic gas-discharge type suitable for installation in flush panel mounting shelves. Indicator shall provide for two non-isolated input circuits. Input signal level shall be 4-20 mA DC through a shelf-mounted 250-ohm resistor. The units shall contain an integral power supply suitable to energize two 4-20 mA DC, 2 wire transmitters. Unit power supply shall be 24 VDC. Indicator accuracy shall be plus or minus 0.5 percent of span with a repeatability of 0.1 percent of span. Indicator scales shall be in engineering units.

B. **Digital Indicators**:

1. Digital indicators shall be self-contained instruments that display process signals directly in engineering units. The unit shall be suitable for panel mounting and shall utilize an LED display where numerals are no less than [0.5-inch] height.

2. The input signal to the digital process indicator shall be 4-20 mA DC or 1-5 VDC. The input sample rate of the unit shall be a minimum of 2 per second. The unit shall have an auto-zeroing feature and shall have provisions for field adjustable scaling and offset. Accuracy shall be plus or minus 1 least significant digit. Input power to the digital indicator shall be 120 VAC, 60 Hz.

B. **Totalizers**: The totalizers shall be solid state C-MOS logic type with minimum 8 non-resettable LCD digits. Totalizers shall be approximately 2 inches high by 2 inches wide by 3 inches deep, suitable for front panel mounting. Character height shall be 0.140 inch minimum. Each totalizer shall have a standby battery capable of maintaining the last totalized value for a minimum of 72 hours after a utility power failure. Power supply shall be from transmission signal which shall be 6 to 250 volts AC or DC or DC switch closure. Maximum count speed shall be 3600 counts per minute.

C. **Current Alarm Trip Switches**: Current alarm trips shall be single or dual type as indicated. Units shall accept voltage or current input signals. Dead bands shall be factory set at 1.0 percent of full span for dual trips and adjustable over 100 percent of span for single trips. Alarm trips shall be equipped with 10 A DPDT contacts. Alarm trips shall include setpoint dials calibrated 0 to 100 percent for each trip point. Single alarm trips shall include a dead band adjustment dial calibrated 0 to 100 percent.

D. **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.

E. **Indicating Lights**: Indication lights shall be incandescent push-to-test type and shall be heavy-duty, oil-tight. Each light shall have a screwed-on glass prismatic 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 6.3 volt lamps.

F. **Alarm Annunciator Systems**:

1. Alarm annunciator systems shall consist of a back lighted window display, alarm modules, flasher-audible modules, power supply, and horn. All annunciators which are installed in NEMA 3, 3R, 4, or 4X enclosures shall be protected by window kits which preserve the panels NEMA rating. Annunciator shall be furnished with (integral)(remotely mounted) acknowledge, test, reset, and silence, pushbuttons. The alarm sequence shall conform to ISA M-1 as follows:

a. Alarm condition sounds the horn and causes the display to flash.

b. Depression of the Acknowledge Pushbutton causes the horn to go silent and the display goes from flashing to continuously lit and remains illuminated until the alarm condition ceases to exist.

c. Depression of the Reset Pushbutton, subsequent to the process condition returning to a normal condition, returns the sequence to a normal state.

d. Depression of the Test Pushbutton shall simulate simultaneous abnormal process conditions on all related alarm points to reveal lamp or circuit failures.

2. **Alarm Modules:** Alarm point modules shall be solid state electronic devices. Each module's relay contacts shall be configured [normally open] [normally closed] to accept dry inputs. The annunciator shall provide [24 VDC] [48 VDC] [125 VAC] wetting voltage for all inputs. All input and alarm logic shall conform to the surge test immunity requirements of IEEE-472-1974. All solid state logic circuits shall conform to the requirements of SAMA PMC 33.1 "Electromagnetic Susceptibility of Process Control Instrumentation" in their ability to resist Radio Frequency Interference (RFI) with the control panel doors open. The time period between the operation of the field contacts and the annunciation of the alarm state shall not exceed 50 milliseconds. Each alarm module shall be field configurable for normally open or normally closed contact operation. [Time delay circuits, adjustable from [0.7 to 1] [.4 to 6] seconds shall be provided for [each alarm point] [for indicated points] to prevent false operation due to extraneous circuit pulses or electrical transients]. Alarm modules and flasher-audible modules shall be easily removable for ease of inspection and servicing. Alarm logic shall be provided for all currently utilized and spare display points.

3. **Alarm Display:** Annunciator windows shall be translucent white with black letters. Annunciator cells shall be approximately 2"/50mm high and 3"/75mm wide. Each window shall have two high intensity 6 volt, 1 watt lamps rated at 20,000 hours. The lamps shall be wired so that the burnout of a lamp will not affect the other lamp. All lamps shall be replaceable from the front of the annunciator.

4. **Window Engraving:** The window arrangement and associated text shown in the Contract Documents shall be interpreted as a guideline only which is subject to modification at the time of submittal by the Construction Manager. All lines of characters shall be centered in the window. All characters shall be engraved in the same size and line thickness all in conformance with the requirements of ISA-RP60.6 (Nameplates, Labels, and Tags for Control Centers) with a recommended viewing distance of 3'/1m to 6'/2m. All characters shall be in uniformly and symmetrically spaced to give a clear, easy-to-read, informative display. Each window shall have two high intensity 67 volt, 1 watt lamps rated at 50,000 hours. The lamps shall be wired so that the burnout of a lamp will not affect the other lamp. All lamps shall be replaceable from the front of the annunciator.

5. **Audible Alarm Horn:** Solid state tone generators shall be located in the annunciator or control panel enclosure. The adjustable tone generator shall activate an alarm [horn] [chime] [buzzer] [speaker] located on the front of the annunciator. The sound shall be [continuous] [intermittent] until silenced by manual pushbutton operation. The sound shall be adjustable between steady and fluctuating or warble. [The audible alarm shall silence automatically after an adjustable time.] Audible devices shall conform to the environmental requirements that apply to other panel mounted devices.

6. **Power Supply Systems:** Each annunciator shall be provided with its own dedicated redundant 24 VDC power supplies. The sharing of power supplies with panel power shall not be permitted. Power supplies shall provide electrical isolation between power sources and annunciator circuits. Ground detectors shall annunciate the occurrence of accidental circuit grounds. The power supply system shall enable the offending grounds to be located and removed without affecting the annunciator operation or the power source. The power supplies shall be redundantly configured with diode auctioneering to enable the transition between a failed power supply to the backup without impact to the annunciator and to enable the replacement of a failed supply without impact to the annunciator's operation. Power failure detectors shall be provided to alarm the failure of each power source and each power supply to an independent alarm device.

7. **Retransmit Contacts:** All alarm inputs to the annunciator and audible relays shall have retransmit contact outputs for input to other equipment. Retransmit contacts shall be a field contact follower and utilize gold flashed contacts rated at 5 amps at 24 VDC [or] [125 VAC and 0.1 amp at 125 VDC resistive.]

8. **Pushbuttons:** Annunciator pushbuttons shall be provided for Alarm Acknowledge, [Silence], Reset, and Lamp test functions as shown on the contract drawings. All pushbuttons shall be momentary manual switches that cause a change from one annunciator sequence state to another. Pushbuttons shall be heavy duty and conform to the environmental requirements that apply to other panel mounted devices. Pushbuttons shall be located to facilitate convenient operation and access while minimizing the possibility of accidental operation of other nearby pushbuttons. Interlocks shall be provided to (1) require the operation of the Acknowledge pushbutton prior to alarms being Reset (2) require operation of silence and acknowledge pushbuttons in sequence to avoid accidental loss of alarm indications.

G. **Proportional Plus Manual Reset Process Controllers:** Proportional plus manual reset controllers shall be microprocessor based single loop controllers. Units shall have front panel bar graph or digital indicators with scales in engineering units as indicated. Vertical process and setpoint bar graph indicators shall have accuracies of plus or minus 0.5 percent of span. Fully adjustable high and low alarm set points shall be provided as indicated. Alarm outputs shall be indicated on the face panel of the controller.

1. Units shall be suitable for operation for temperature variations from 40 to 120 degrees F and over a range of relative humidities from 10 to 90 percent.

2. Controllers shall operate on 120 VAC, 60 Hz. Power supplies, if required, shall be provided. All accessories required for adjustment of control parameters shall be provided. Enclosures shall be nominally 3 inches by 6 inches, suitable for separate or multiple panel mounting.

3. Controllers shall include manual-automatic selection, fully adjustable proportional plus manual reset modes, bumpless transfer switching, setpoint control and indications, high and low output limiters, controlled variable and output signal indicating scales. Controllers shall accept 4-20 mA input signals and output a similar signal. In the event of a power loss with controller in either automatic or manual mode, all controller settings shall return to the last value after power is restored. Proportional band shall be fully adjustable from 3 percent to 500 percent. Manual reset controls shall be continuously adjustable from 0 to 100 percent of scale. Controllers shall include manual increase/decrease pushbuttons. Indicated controllers shall include a remote setpoint feature including a remote/local selector switch. Remote setpoint input signal shall be 4-20 mA.

2.6 PROGRAMMABLE LOGIC CONTROLLER (PLC):

A. Where required, the DESIGN-BUILDER shall furnish, install, program, test, calibrate, fully configure and place into operation Programmable Logic Controllers (PLCs) as specified herein. These requirements also pertain to all PLCs provided under Divisions 11, 15, and 16.

B. **General:** The DESIGN-BUILDER shall furnish all necessary interconnecting cables, all accessories, and all appurtenances as indicated herein or as required for proper operation of the system. All major PLC components of the system shall be of the same manufacturer and PLC family product line. All equipment shall be housed in an enclosure or control panel suitable for the intended operation and location. The PLC system shall be capable of tolerating and capable of riding through a power interruption of 8 milliseconds or less without interruption of normal operation. The PLC system shall be Allen Bradley to match existing.

C. **Construction:** The PLC central processing unit (CPU) shall be of solid-state design. The PLC system shall be provided with a housing or chassis with enough slots to handle all power supplies, CPUs, I/O cards, and communication modules. All CPU operating logic shall be contained on plug-in modules for quick replacement. Chassis wired logic is not acceptable. The controller shall be capable of operating in a hostile industrial environment (i.e., heat, electrical transients, RFI, vibration, etc.) without fans, air conditioning, or electrical filtering (up to 60 degrees C and 95 percent humidity).

D. **Design:** The PLC shall be furnished with I/O (input/output) modules suitable for interfacing with new and existing field devices. The PLC I/O modules shall be 4-20 mA signals for analog inputs and analog outputs and shall be 24 VDC and/or 120 VAC signals for discrete inputs and discrete outputs. The PLC shall provide internal fault analysis with a fail-safe mode and a dry contact output for remote location alarming, and a local indicator on the PLC frame in the event of a fault in the PLC.

E. **Central Processor:** The central processor shall contain all the relays, timers, counters, number storage registers, shift registers, sequencers, arithmetic capability, and comparators necessary to perform the specified control strategy functions. It shall be capable of interfacing sufficient discrete inputs, analog inputs, discrete outputs, and analog outputs to meet the specified requirements plus an additional 25 percent excess capacity. The power supply shall contain capacitors to provide orderly shutdown in the event incoming power does not meet specifications. If this occurs, the processor shall cease operation, forcing all outputs off. The processor shall have a key type memory protect switch to prevent unauthorized program changes. The central processor shall be 32-bit, minimum.

F. **Memory:** The programmable controller memory shall be Complementary Metal Oxide Semi-conductor (CMOS) based memory with battery backup or Erasable Programmable Read-Only Memory (EPROM) based memory. The CMOS memory shall be a minimum of 21K with sufficient battery backup to retain the program during power interruptions of up to 1 year. An indicator shall show the status of the batteries. A reference shall be available through the discrete outputs to alarm the operator that the batteries should be changed.

The PLC shall be supplied with sufficient memory to implement the specified control strategy functions plus a reserve capacity of 25 percent of the total provided. This reserve capacity shall be totally free from any system use. The memory shall be programmed in a multi-node configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.

G. **Controller:** The controller shall have its control strategies programmed in a "ladder logic" language. It shall be easily reprogrammed with a laptop computer as specified below. The PLC system shall be programmed by the DESIGN-BUILDER to perform the specified control strategies and monitoring functions. Two documented copies, in hardcopy and electronic format, of the operating PLC program(s) shall be furnished to the OWNER which shall allow direct, step-by-step, reloading of the PLC system program(s). The ladder logic shall reflect equipment name designations used in the PLC as well as the Contract Drawing equipment name designations (i.e., timer "Q" in the Contract Drawing may become timer OL in PLC program).

H. **Power Supply:** The PLC shall be provided with all requisite power supplies and shall operate at the following:

1. 120V ac RMS plus or minus 15 percent continuously.

2. 120V ac RMS plus or minus 30 percent maximum 30 seconds.

3. 120V ac RMS plus or minus 100 percent maximum milliseconds.

4. Line spikes at 1000V ac (5000 micro-seconds duration; 0.05 percent maximum duty cycle).

I. **Input/Output Modules:** All I/O housings and I/O modules shall be of rugged construction with modules in place. Sufficient input and sufficient output modules shall be provided with the PLC to implement the specified control functions plus a reserve capacity of 25 percent of the total provided. All PLC I/O shall be arranged in a distributed I/O configuration such that the failure of any I/O card will not affect multiple items of the same equipment.

1. Discrete Input Modules: Defined as contact closure inputs from devices external to the programmable logic controller module. Input modules shall be shielded from short time constant noise and 60-Hz pickup. Individual inputs shall be optically isolated for low energy common mode transients to 1500 volts peak from user's wiring or other I/O Modules. The modules shall have LED lights to indicate a discrete input.

2. Discrete Output Modules: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable logic controller module. The output modules shall be fused (typically 5-amp at 115V ac) with blown fuse indicator lights. The output modules shall be optically isolated from inductively generated, normal mode and low energy, common mode transients to 1500 volt peak. All output modules shall have LED lights to indicate output has been cycled ON by the controller.

3. Analog Input Modules: Defined as analog inputs for 1 to 5 VDC or 4 to 20 mA dc signals, where an analog to digital conversion is performed and the digital result is entered into the processor. New inputs shall be provided for every scan.

4. Analog Output Modules: Defined as analog output for 1 to 5 VDC or 4 20 mA dc signals, where a digital to analog conversion is performed and the analog result is produced as an output. New outputs shall be produced on every scan.

J. **Data Access Panel:** Where required, a Data Access Panel with LCD display and keypad shall be provided to allow the operator to monitor and make changes in internal registers for set points, timers, and counters in the PLC. Program logic or sequence changes shall not be made from this panel unless a security code or key lock is used to prevent unauthorized changes. Interconnecting cables between the Data Access Panel and the PLC shall be provided.

K. **Communications:** If the PLC is required to interface with the DCS via a datalink, is shall be done so by an RS422 or RS232 serial link. The serial link type used shall be determined by distances. The PLC system shall be provided with all appurtenances to support this requirement. The communications protocol shall be MODBUS with the PLC configured in a slave mode. The DCS will operate in the master mode.

L. **Programming Laptop:** All programming shall be accomplished with a laptop computer. The laptop shall be capable of being directly plugged into the PLC system without the requirements of additional hardware. All programming, all monitoring, all searching, and all editing shall be accomplished with the laptop. These functions shall be capable of being done both "on line" while the PLC processor is scanning or "off line" while the PLC processor is not scanning. The laptop shall display multiple series and parallel contacts, coils, timers, counters, and calculation functions. The laptop shall also be able to monitor the status of all inputs, all outputs, all timers, all counters, and all coils. It shall have the capability to disable/force all inputs, all outputs, and all coils to simulate system operation. It shall also indicate "power flow" through all elements and include a search function to locate any element and its program location. The PLC processor status information, such as error indication and amount of memory remaining, shall be shown on the laptop screen. The DESIGN-BUILDER shall provide one new laptop complete with manuals to the OWNER to enable future system support. The laptop shall be turned over to the OWNER at START-UP.

M. **PLC Control System Software:** This Section covers the furnishing of standard and customized software, fully installed and fully configured in the control systems specified herein. It is the intent of this specification to have the PLC System Supplier furnish his latest generation, standard, field proven, fully debugged and supported software package for this application with a minimum of additions or changes. Customized or specially written software shall be furnished if required to meet all of the functional requirements specified herein. Any custom applications software required shall be fully integrated into the basic software and shall not require unique command structures. Software specified herein is described in broad, functional categories. The System Supplier shall furnish a complete software package including the functional requirements specified herein along with whatever additional software is required by the supplier for proper and efficient operation of the PLC Control System. No attempt has been made to list all software or list all characteristics of software required by the System Supplier to meet the functional requirements specified herein.

1. General: The software package shall provide a system capable of controlling system level activities and a higher level process control language allowing the operator to monitor and control the process through an interactive human interface. The software environment shall support a multi-programming atmosphere allowing concurrent execution of more than one program in a background/foreground mode or multi-tasking mode.

2. Throughout the execution of all software modules, the operator shall be presented with all of the command or operation choices available at that point in the program using sufficient verbiage or symbols to make the choices self-explanatory and unambiguous. Question and answer or fill-in-the-blank requests shall only be permitted where file names, tag names, or other unique text or numerical information is required.

3. System-level software shall include a real time operating system, a calendar/time program, a file management program and a system of diagnostic routines in addition to any compilers, editors, loaders, or assemblers required to support the process control software language.

4. All programs shall be self-configuring, such that they obtain the size and configuration of the system from parameters contained in the various files created during system generation. No parameters related to the hardware configuration shall be hard coded into any of the software.

5. System Level Software: System-level software shall include a complete and unmodified operating system furnished by the System Supplier that provides system-level functions as specified herein. Operating system software shall function automatically without operator intervention, except as required to establish file names and similar information.

6. Operating System Software: The real-time operating system software shall be the standard uncorrupted product of the host computer and shall provide the following minimum functions:

    a. Respond to demands from a program request or to demands from an operator.

    b. Dynamic allocation of the resources available in the system. These resources shall include main memory usage, computation time, peripheral usage, and I/O channel usage.

    c. Allotment of system resources on the basis of task priority levels such that a logical allocation of resources and suitable response times are assured.

    d. Queuing of requests in order of priority if one or more requested resources are unavailable.

    e. Resolution of contending requests for the same resource in accordance with priority.

    f. Service requests for execution of one program by another.

    g. Transfer data between programs as requested.

    h. Management of all information transfers to and from peripheral devices.

    i. Control and recovery from all program fault conditions.

    j. Diagnose and report real-time hardware device errors.

7. Program execution shall be scheduled on a priority basis. A multilevel priority interrupt structure is required. A program interrupted by a higher priority program shall be entered into a list of pending programs. Its execution shall be resumed once it becomes the currently highest priority program. Initiation of programs shall, as a minimum, be activated in the following ways:

   a. In response to external interrupts.

   b. At a scheduled time of the day.

   c. On an elapsed time interval basis.

   d. On request by another program.

   e. On request from the data access panel.

8. The system shall allow periodic programs to be scheduled. The allocation of resources to a time scheduled program shall be based on its relative priority ad the availability of computer system resources.

9. Start-up and Restart: Software shall be provided which initializes and brings a computer or any microprocessor based hardware unit from an inactive condition to a state of operational readiness.

   Initialization shall include determination of computer system status prior to start-up of initializing operating system software and initializing application software. Initialization shall also include the loading of all memory resident software, initialization of timers, counters, and queues, and initialization of all dynamic database values.

10. Shutdown: The software shall provide an orderly shutdown capability for shutdowns resulting from equipment failure, including computer processor failure, primary power failure, or a manually entered shutdown command. When the loss of primary power is sensed, a high-priority hardware interrupt shall initiate software for an immediate, orderly shutdown. When a shutdown occurs in response to a command or malfunction, the software shall control the affected hardware quickly and automatically to a secure state.

11. Diagnostics: Diagnostic programs shall be furnished with the software package to detect and isolate hardware problems and assist maintenance personnel in discovering the causes for system failures. The system manufacturer's standard diagnostic routines shall be used as much as possible. Diagnostic software and test programs shall be furnished for each significant component in the system.

    Diagnostic routines shall test for power supply, central processing unit, memory, and I/O bus failures as a minimum.

12. Calendar/Time Program: The calendar/time program shall update the second, minute, hour, day, month and year in the operating system and transfer accurate time and date information to all system level and application software. Variations in the number of days in each month and in leap years shall be handled automatically by the program. The operator shall be able to set or correct the time and date from the data access panel, only at the highest security level.

N. **Operator Interface**: System-level software shall provide for creation and modification of alphanumeric displays, compression of display information for storage, and linking of dynamic files to database variables. Each display screen shall be able to be made up of static and dynamic alphanumeric information. The system shall be furnished with standard displays as specified herein. The system shall be capable of storing and utilizing all standard display formats.

Additionally, all display screens shall include a dedicated area that shall display the current time and date, and at lease one line for system-level messages.

O. **Standard Displays:** The operator interface systems shall include at least the following standard, non-configurable displays.

1. Current Alarm Summary--As specified in the alarm processing section of this document.

2. System Overview--Displaying the current status of major systems hardware components including the input/output hardware.
3. Menu Displays--Indicating the various displays and application level choice available to the operator.

4. Point Displays--Detailed displays in a standard format for all types of points in the system. Any point in the system shall be able to be displayed indicating all parameters associated with the point. Each entry in the display shall be labeled in engineering units.

P. **Algorithms:** System software shall support the implementation of algorithms for the determinations of control actions and special calculations involving analog and discrete inputs. These algorithms shall be capable of outputting positional or incremental control outputs or providing the product of calculations. The algorithms shall include alarm checks where appropriate. As a minimum, the following types of algorithms shall be provided.

1. A calculator algorithm which performs functions such as summing several variables, raising to a power, roots, dividing, multiplying, and subtracting.

2. A switch algorithm which reads the current value from its input address and stored it as the value of its output address. Two types of switches shall be accommodated, 2 outputs with one input and one output with 2 inputs.

3. A 3 mode Proportional-integral-Derivative (PID) controller algorithm, with each of the 3 modes independently adjustable. The algorithm shall support both direct and reverse acting modes.

4. Algorithms for lead, lag, dead time, and ration compensators.

5. Algorithms to perform integration and totalization of analog process variables.

6. Algorithms that drive the set point of a controller shall include provisions for bumpless transfer, which shall be implemented by use of a bias value.

7. Algorithms shall be implemented and modified in the system at any time through the use of interactive software modules in a manner consistent with other interactive modules and shall not required any direct source of code changes.

Q. **Alarm Processing**

1. Alarm processing software shall be provided to recognize and report alarm events and conditions to the Local Control Panel in an organized, unambiguous, clear, and convenient manner. Alarms shall be classified into at least 2 priority levels and at least 2 independent classes.

2. Alarm processing software shall generate alarms for the following conditions:

   a. Discrete input or output change of state is defined as an alarm in the control software.
   b. Analog value exceeding alarm limits defined in the control software.

   c. Analog rate of change exceeding limits defined in the control software.

   d. Failure of the PLC processor, mass memory device, process input/output hardware, or other major hardware component.

   Alarms shall be generated in each case above at the time of occurrence and at the time the condition returns to normal.

R. **Testing:** The CONSTRUCTION MANAGER shall witness testing of the PLC system. Solid-state logic systems shall be tested as complete assemblies. Testing of individual components or modules shall not be acceptable.

S. **Training:** A manufacturer's representative shall supply two 8-hour days of on-site training for the OWNER'S personnel. The training shall include but not be restricted to, operation of programming unit, trouble shooting of system hardware and software, and program development.

T. **Seven Day Acceptance Test:** After start up has been completed, the System shall undergo a 7-day acceptance test. The System must run continuously for 7 consecutive days. During this period, all System functions shall be exercised. Any System interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as time of occurrence and duration of each failure. A failure shall cause termination of the 7-day acceptance test. When the cause of a failure has been corrected, a new 7-day acceptance test shall be started.

Each time the DESIGN-BUILDER's technician is required to respond to a System malfunction, he must complete a report which shall include details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.

U. **Operations and Maintenance Manuals:** The DESIGN-BUILDER shall furnish to the OWNER 5 complete sets of operation and maintenance manuals. The manuals shall include date, information drawings, etc., for the system, subsystem, and all components, and shall include names, addresses and telephone numbers of equipment suppliers, representatives and repair facilities.

This shall include a complete description of the recommended operating procedures, maintenance procedures, and spare/replacement parts list for equipment items with catalog data, diagrams, and drawings or cuts describing the equipment. Each set shall include full size assembly and wiring diagrams; drawings showing "as-build" conditions shall be furnished to the OWNER.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER for rework because of DESIGN-BUILDER 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. The DESIGN-BUILDER shall install pneumatic instrument air systems according to the manufacturer's installation instructions and the following:

1. Install all pneumatic tubing and make all connections at control panels, instruments, and control valves.

2. Perform field engineering as required for instrument air supply headers and individual air supply taps and lines.

3. Check all air supply branch headers by blowing with clean air and checking for tightness.

4. Clean all transmission and control tubing by blowing with dried and filtered air prior to connecting to instrument components.

5. Leak test all pneumatic control circuits in accordance with ISA Recommended Practice RP-7.1.

6. Set all instrument air regulators at manufacturer's recommended supply pressures.

D. 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.

E. The DESIGN-BUILDER'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.

F. 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.

G. Where job conditions require minor changes in approximated locations and arrangements, the DESIGN-BUILDER shall make such changes without additional cost to the OWNER.

H. 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.

I. 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 megometer 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.

3.3 INSTALLATION, CALIBRATION, TESTING, PRECOMMISSIONING, STARTUP AND INSTRUCTION**Error! Bookmark not defined.**

A. **Installation and Connection:** The DESIGN-BUILDER 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. Thermocouple lead wire shall be provided in dedicated conduit or wireway from the thermocouple to the control panel. Conduit or wireway shall be sized in accordance with the capacity of the instrument.

5. All power and all signal wires shall be terminated with spade type lugs.

6. All connectors shall be, as a minimum, water tight.

7. After all installation and connections have been completed, a technical field representative of the DESIGN-BUILDER 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 DESIGN-BUILDER that each loop and system meets requirements.

8. 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 DESIGN-BUILDER 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 DESIGN-BUILDER shall be responsible for loop checking and testing all instrumentation loops with this project. The DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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 DESIGN-BUILDER 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. Air systems shall be tested for leaks in compliance with ISA RP7.1.

5. 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 success fully calibrated, fully inspected, and fully tested.

D. **System Pre-commissioning:** The DESIGN-BUILDER shall responsible for demonstrating the operability of all systems provided under this specification. The City will assist and coordinate the operability assessment with the DESIGN-BUILDER. 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 DESIGN-BUILDER 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 the use of water 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 DESIGN-BUILDER 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 DESIGN-BUILDER shall furnish his own personnel, electrical personnel, and any instrument manufacturers representatives as required during the testing period required in Section 01660 to produce a fully operational system.

F. **Instruction:** The DESIGN-BUILDER 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 DESIGN-BUILDER 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.

3.4 PROCESS CONTROL STRATEGIES

A. The control strategies shown in Appendix A 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 DESIGN-BUILDER 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.

C. Each strategy is described as follows:

1. **Overview**: A brief description of the mission of the related strategy including the roles of logic, monitoring and control stations located/associated with MCCs, field situated, and , DCS -based.

2. **Detailed Strategy Functions**: A detailed description of each and every monitoring and control function associated with the associated strategy. This description addresses the strategies reaction to sensor failures, process equipment failures, control device failures, DCS malfunctions, and power interruptions. All control modes (MCC, local hand station, local control panel, DCS keyboard) are fully described. These descriptions are augmented by a listing of all instruments, valves, control devices, process equipment, and DCS equipment associated with the noted strategy. All control sequences associated with equipment activation, deactivation, process startup and process shutdown are defined along with all required time delays.

3. **Preface to Control Strategy Section**:

Tag numbering system
Definitions and terms
Controls and control functions provided for all equipment, unless otherwise noted
Local control station at equipment
Local/DCS switch
Alarms logic - open contact for alarms (fail-safe)

4. Format for Each Strategy

a. General Description

(1) An overall description of the process
(2) Major control components (PCM, PLC, annunciator, panels)
(3) General function of each major control component
(4) P & ID references for this strategy
(5) Reference to I/O listing

b. Related Equipment:

c. Overview of Strategy

d. Non-DCS Control

(1) Local Manual Control: Description of monitoring and control from each equipment item. If this is covered by the general statement in the Preface, describe any deviations. Example: "Because of inaccessibility location of this valve in the sump, a local control station is not provided."

(2) Remote Manual Control: Description of control from any local or area control panels. Other Control: Package system, PLC, etc.

e. DCS alarm, monitoring and control functions

(1) DCS Manual Control

(2) DCS Automatic Control

(3) Alarms - define alarms and alarm priorities. Define level (1, 2, 3, or 4) for each alarm

f. Failure Modes

g. Communications Interfaces

h. In-Service/Out of Service Algorithm: Description of devices which determine in/out of service status for each piece of equipment. (In-service (I/S)/out of service (OOS) algorithms mask or block out all or selected alarms associated with the OOS device (i.e., if a wetwell is declared OSS, low level alarms shall be inhibited). Additionally, if a device has been designated OOS, all control routines shall declare the equipment as being unavailable for service.

See Appendix A for detailed descriptions of the process control strategies.

3.5 INSTRUMENT SUMMARY

A. **General**: The Instrument Summary (IS) shown in Appendix C itemizes the instrumentation devices, including control panels, to be furnished under this contract. Specific device requirements for the instrumentation referenced in Part 2 shall be included in the instrument summary such as meter size, ranges, scales, set points, NEMA ratings, flange sizes, pipe connection sizes, material types, probe types, etc.

B. Each column on the Instrument Summary is defined as follows:

1. Tag Number: The identifier assigned to a device which performs a function in the control system. The DESIGN-BUILDER shall use this identifier in tagging devices in the field.

2. Loop Number: The number assigned to the control loop associated with the device.

3. Description: A process-oriented functional description which defines the measured/monitored/controlled parameter and the associated process/process equipment.

4. P&ID Drawing Number: The Process and Instrumentation drawing upon which the device appears.

5. Technical Specification Number: The number associated with the technical specification which describes the requirements associated with the device.

6. Specification Section Number: The specification section under which the device shall be provided.

7. Control Panel Number: The designation of the control panel where the device resides.

8. Control Panel Reference Number: The drawing or schedule number associated with the control panel's face-plate representation.

9. Mechanical Drawing Number: The mechanical drawing upon which the device appears.

10. Electrical Drawing Number: The electrical drawing upon which the device appears.

11. Installation Detail Number: The designation of the installation detail defining the installation requirements associated with the device.

3.6 DCS INPUT/OUTPUT (I/O) SUMMARY

A. **General:** The I/O list contained in Appendix B itemizes all inputs and outputs to and from the DCS, both hardwired and data linked, which are furnished by the DESIGN-BUILDER.

B. Each column on the I/O List is defined as follows:

1. Tag Number: The ISA identifier assigned to a device which performs a function in the control system. The DESIGN-BUILDER shall use this identifier in tagging devices in the DCS.

2. Loop Number: The number assigned to the control loop associated with the I/O.

3. Description: A 30-character process-oriented functional description which defines the measured/monitored/controlled parameter and the associated process/process equipment.

4. Alarm Priority: A 0-3 designation that determines the severity of the alarm triggered with 3 being the highest (most severe) and 0 the lowest.

5. Scale: The top value and bottom value of the analog process variable to be displayed or controlled by the DCS.

6. Set: The status to be displayed on the alarm summary when a digital point is activated.

7. Reset: The status to be displayed on the alarm summary when a digital point is not activated or returns to its normal state.

8. P&ID Drawing Number: The Process and Instrumentation drawing upon which the device appears.

9. I/O Type: The type of I/O required for current and future monitoring and control activities (spare I/O is not included).

    a. Analog Input (AI): If the tag number generates an AI, the quantity of AIs are listed here.

    b. Analog Output (AO): If the tag number generates an AO, the quantity of AOs are listed here.

    c. Discrete Input (DI): If the tag number generates a DI, the quantity of DIs are listed here.

    d. Discrete Output (DO): If the tag number generates a DO, the quantity of DOs are listed here.

10. Data link No.: The name of the data link the soft I/O point is associated with.

11. PCM /RIO/PLC Number: The designation of the PCM, RIO, or PLC where the I/O resides.

12. Fail-safe: (Yes or No) : For digital inputs, whether the field device is to be wired as "open contact on alarm".

13. Remarks: Any clarifying remarks are made in this area such as pulse inputs, cross references to mechanical and electrical drawings on which the PCM appears.

14. Totals: A summary row shown at the bottom of the I/O list which indicates the total amount of each type of I/O associated with a PCM. I/O associated with future shall be separately tabulated.

**** END OF SECTION ****

APPENDIX A - CONTROL STRATEGIES

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

PROJECT OVERALL CONTROL SYSTEM STRATEGY OVERVIEW

[Provide a brief overall project control strategy overview]

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 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 sired 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 unction 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.

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 compressor'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.

DCS is configured as the primary control system for all alarm monitoring, start/stop sequencing, shutdown and interlock and basic process control functions.

When delineated within individual control strategies as DCS controlled or DCS logic, the control program is resident within the DCS system. Complex control algorithms and historical data calculations are normally performed by the DCS system.

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 has 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.

The DESIGN-BUILDER shall be responsible for all control software to operate the centrifuge is exactly the same manner as the existing centrifuges are operated. The operator should see no difference in the controls presented or the statuses shown on the DCS for the new centrifuges 2-6 vs. the existing and remaining centrifuges 1 and 8. All controls system, I/O connections and programming shall be performed by the combination of the centrifuge supplier and the DCS integrator so that the operations of the new centrifuges are identical to the existing centrifuges.

APPENDIX B – DCS I/O List

DESIGN-BUILDER to complete the DCS I/O List.

APPENDIX C – Instrument List

DESIGN-BUILDER to complete the Instrument List.

SECTION 13400 - DISTRIBUTED CONTROL SYSTEM (DCS)

PART 1 --GENERAL

1.1 WORK OF THIS SECTION

A. The DESIGN-BUILDERDESIGN-BUILDER shall furnish all equipment and provide all needed engineering to accomplish the functional and technical requirements of these Contract Documents including, but not limited to, project management, design assistance, coordination with plant staff, detailed system design and integration, conducting graphic development meetings, equipment supply, shipment, storage, job site delivery, programming and configuration, installation oversight, training, calibration, testing, startup, and maintenance. The DISTRIBUTED CONTROL SYSTEM (DCS) shall be provided by Emerson Process Management (EPM) and the DCS shall be Emerson Ovation to match existing.

B. It is the intent of these specifications to have the DESIGN-BUILDER singularly responsible for the procurement, supply, delivery, implementation and future support of all DCS equipment (i.e., hardware and software). In order to preserve this focused responsibility, DESIGN-BUILDER shall procure the services of EPM to ensure the following:

1. Be the manufacturer of the DCS hardware being proposed for this project or offer the hardware in their standard product line.
2. Be the originator of all data acquisition and control software.
3. Be the integrator of all Workstation (WS) and communication software.
4. Be the programmer and integrator of all DCS functions.
5. Be the source of all DCS documentation.

C. The DESIGN-BUILDER shall be responsible for providing all equipment, labor, engineering, and services associated with integrating all of the instrumentation and Control devices, and special systems (Fire Detection, Energy Management, HVAC, CCTV, and control valve data links), into the DCS in a transparent and seamless manner.

D. The DESIGN-BUILDER shall perform all project management, hardware integration, submittal preparation, configuration, training, testing, maintenance and warranty work at the Kearny Mesa facility close to the Metropolitan Operations Center (MOC).

E. As a minimum, the DESIGN-BUILDER shall assume full responsibility for the following:

1. Implementation of the DCS:
   a. Provide all engineering, resources, equipment, and labor required to:
      1) Design and submit DCS hardware, software, and spare part submittals.
      2) Design and submit DCS training submittal for training to be conducted at the Department Headquarters and at the Project Site.
      3) Conduct user meetings at the Department Headquarters dedicated to the development of graphic criteria and design of graphic screens.
      4) Submit all required graphic criteria and graphic design submittals.
      5) Procure all hardware and software required to conform to these specifications.

6) Program, configure, and integrate all software into hardware platforms as required to conform to these specifications.

7) Prepare all required classroom training materials and conduct all training at the Department Headquarters and at the Project Site.

8) Perform an Operational Readiness Test (ORT) near the Department's Headquarters or the project site to verify conformance of the DCS to these specifications.

2. Integration of the DCS with the facility:

a. Provide all engineering, resources, equipment and labor required to:

1) Attend meetings as defined in the scope of work, held at the Department Headquarters and at the project site.

2) Review all loop drawings generated for all control and instrument devices associated with each facility and verify system compatibilities.

3) Install DCS equipment, data communications devices, fiber optic and other communications cables and other equipment as specified in these Contract Documents.

4) Coordinate with suppliers for data link information and configure DCS data links to communicate equipment furnished by others.

5) Oversee the performance of on-site loop and commissioning tests by others.

6) Conduct a 30-day DCS performance test for any new equipment provided.

7) Update and submit all documentation and previous submittals to reflect "as-built" or record conditions.

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 09800 Protective Coating

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. Uniform Fire Code

2. National Electrical Code

3. Underwriters Laboratory (UL) (or third-party certification that work meets UL requirements)

B. Where the requirements set forth in the Contract Documents are greater or more rigid than the mandatory requirements referenced herein the applicable portions of the Contract Documents shall govern.

C. In the case of conflict between any mandatory requirements and the Contract Documents, the mandatory requirement shall be followed in each case, but only after submitting such proposed changes to the CONSTRUCTION MANAGER for approval.

D. Nothing contained in the Contract Documents shall be so construed to conflict with any national state, municipal, or local laws or regulations governing the installation of Work specified herein, and all such acts, ordinance, and regulations, including the National Electrical Code, are hereby incorporated and made a part of the Contract Documents. All such requirements shall be satisfied by the DESIGN-BUILDER at no additional expense to the OWNER.

1.4 SPECIFICATIONS AND STANDARDS

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

1.	ISA-S5.1	Instrument Symbols and Identification
2.	ISA-S5.4	Instrument Loop Diagrams
3.	ISA-S12.4	Instrument Purging for Reduction of Hazardous Area Classification
4.	ISO 9001	Quality systems - Model for Quality Assurance in Design/Development, Production, Installation and Servicing
5.	SAMA	Scientific Apparatus Makers Association (SAMA) SAMA-PMC-33.1
6.	IEEE 812	Standard Definitions of Terms Relating to Fiber Optics
7.	EIA/TIA-568	Commercial Building Telecommunications Wiring Standard

1.5 ELECTRONIC DOCUMENT SUBMITTALS

A. All final submittals are required in both paper and electronic format. Three copies of each final submittal shall be provided on CD-ROM OR DVD.

B. Where preliminary submittals are required in electronic format, three copies of the preliminary submittal shall be provided on CD-ROM OR DVD for the City's review.

C. File Requirements:

1. Documents shall be in Adobe Acrobat PDF format, version as specified by the Contract Manager. Vendor and DESIGN-BUILDER shop drawings developed under the Contract shall be in Bentley Microstation (.DGN) format. Documents in electronic format (Microsoft Word, Excel, etc.) shall be converted to standard PDF format using the Acrobat printer driver.

2. Deviation from this standard will be accepted only if advance approval is given by the Project Manager.

3. Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) 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.

4. All PDF documents shall be reviewed, and corrected if necessary, for orientation and legibility.

5. Individual document files shall not exceed 3 megabytes in size.

D. Document Organization and Indexing:

1. Submittals shall be logically organized. File names shall be in UPPERCASE only, a maximum of 64 characters, contain no spaces, and clearly indicate the file contents.
2. Supplier's submittals that include O&M documentation for more than one equipment item shall be divided into separate documents for each equipment item.
3. Each document's Table of Contents shall be bookmarked to the referenced sections within the document.
4. A master PDF index file shall be generated, with a master Table of Contents, and links to individual document files. External PDF link file names shall be in uppercase only.
5. A table shall be provided and submitted in spreadsheet format which includes the information about each document file. The contents of the table shall be submitted and approved by the Project Manager. An example of information to be provided is as follows: (This is an example only)
    a. Document file name
    b. Document title and description
    c. Hard Copy Catalog No. (used by facility document coordinator)
    d. Document Type:
        1) Design
            a) Design Specifications
            b) Design Drawings
        2) Operations
            a) Facility design O&M manuals
            b) Facility manufacturer O&M manuals
            c) Standard Operations Procedures
            d) Record Drawings
        3) Maintenance
            a) Maintenance Management System
            b) Facility Loop and Wiring Diagrams
        4) Training
        5) Student study guide
        6) User guides
        7) User manuals
    e. Environmental
    f. Engineering

g. Research & Development

h. Division Processes and Procedures

i. Facility Name

j. Specification Number

k. Process Name

l. Unit Process Number

m. Manufacturer's Name (if applicable)

n. Supplier's Name (if applicable)

o. EMPAC asset number (if applicable)

p. Asset Description (if applicable)

1) Keyword

2) Qualifier

1.6 SHOP DRAWINGS AND SAMPLES

A. The DESIGN-BUILDER shall prepare and submit complete and organized shop drawings, as specified herein. Incomplete or partial submittals are not acceptable. All shop drawings and record drawings shall be submitted in hard and electronic copy. All drawings shall be developed in Bentley Systems MICROSTATION CAD software.

B. The DESIGN-BUILDER shall provide a project loop drawing submittal (PLDS) to verify the DCS interfaces with all instrumentation and devices being provided. For each DCS input/output, the DESIGN-BUILDER shall note on the PLDS the following information:

1. PCM number and physical location.

2. Type of input.

3. Tag number

4. I/O card location and address.

5. All DCS-dependent displayed functions using ISA symbology.

6. Drawing reference for DCS software content.

C. In these Contract Documents all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbology as derived from Instrument Society of America Standard ISA S5.1 (latest revision). The nomenclature and numbers designated herein and on the Drawings shall be employed exclusively throughout shop drawings, and similar materials. Any other symbols, designations, and nomenclature unique to any manufacturer's standard methods shall not replace those prescribed above, used herein, and on the Drawings.

D. All shop drawings shall include the letter head and/or title block of the DESIGN-BUILDER. The title block shall include, as a minimum, the DESIGN-BUILDER'S registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing. The quantity of submittal sets required shall be as specified in Section 2.5.3.3, "DESIGN-BUILDER Submittals".

E. The DCS hardware submittal (DCSHS) shall be a singular all inclusive submittal which shall include, but not be limited to:

1. A complete set of system diagrams which depict:

   a. All Process Control Modules (PCMs), Workstations (WSs), Servers, Historian System (HS) devices, video devices, printers, UPS, telemetry devices, communication devices, network equipment and communication links.

   b. All conduit and wire required to support the power, ground, Input/Output, and communication requirements of the system. A separate diagram shall be submitted for each DCS component fully annotated with conduit size, number, associated with the power source. All conduit and wire numbers shall be consistent with the numbering system shown in these Contract Documents.

   c. All separation requirements between signal, power and communication conductors shall be clearly shown.

2. Comprehensive power diagrams which shall show and identify each component of each system and shall show which components require a nominal 110 volt, 60 Hz power source. Where a voltage regulator is required, it shall be included.

3. Technical data sheets for each component together with a technical projects brochure or bulletin which show:

   a. The component name as used on project drawings and in these specifications.

   b. Manufacturer's model number or other identifying product designation.

   c. The project tag number.

   d. The project system of which it is a part of.

   e. The project site to which it applies.

   f. Input and output characteristics.

   g. Requirements for electric power.

   h. Specifications for ambient operating condition.

   i. Details on materials of construction for those components to be field mounted.

4. Site-specific arrangement and construction drawings for all DCS equipment cabinets, including dimensions, identification of all components, preparation and finish data, nameplates, and the like. All drawings shall be accurately scaled and show the position of the equipment in its intended installation location. All drawings must show a scaled representation of the placement of all DCS equipment being provided under this contract and its spatial relationship to all other equipment (both new and existing) located in the abutting and adjoining areas. All acquired access and clearances associated with the DCS equipment and other equipment must be shown with a statement of compliance to manufacturer's recommendation, NEC and other applicable codes. All drawings must be drawn to a 1/2-inch = 1 foot scale.

5. Installation, mounting and anchoring details for all components and assemblies to be field mounted, including access requirements, conduit connections or entry details. All details must be site specific.

6. Calibration, adjustment and test details for all components and systems.

7. Complete and detailed bill of material.

8. Calculations shall be submitted to verify each network's optical power budget. Calculations shall include the PMD being used, transmitter output power level (dbm), receiver input power level (dbm), losses generated by splices, connectors, and repeaters. The resulting calculations shall represent the allowable end-to-end optical link budgets for use in designing the network.

9. The hardware submittal copies shall be numbered, with controlled distribution. Updates for the DCS Hardware submittal shall be issued whenever the hardware configuration or equipment supplied changes as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

F. The DCS Software Submittal (DCSSS) shall be included in a singular all inclusive submittal which shall include but not be limited to:

1. A complete set of all available software algorithms.

2. A complete set of control strategies which depict all monitoring and control functions on a loop by loop basis, in a modified SAMA-type format.

3. An English narrative of each data acquisition or control loop mission and anticipated action. Narratives shall enumerate the signal point name, signal descriptor, associated PCM number, associated system template displays, system functions activated by signal (i.e., interlocks, alarms, logs, etc.).

4. A complete set of annotated module configuration sheets depicting each loop linkage.

5. A complete listing of the DCS data base listing for each data points relevant parameters such as range, contact orientation, limits, incremental limits, I/O card type, I/O hardware address and assignment.

6. Detailed descriptions of procedures used to implement and modify control strategies and data base construction.

7. The software submittal copies shall be numbered, with controlled distribution. Updates for the DCS Software submittal shall be issued periodically or upon major software configuration changes occur as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

G. The DCS Graphic Submittal (DCSGS) shall reflect the results of process graphics meetings held for the facility. These meetings shall be chaired by the DESIGN-BUILDER and attended by a user group participants and the CONSTRUCTION MANAGER. The DESIGN-BUILDER shall allocate 0.5 hours of meeting time per custom graphic display. The DCSGS copies shall be numbered, with controlled distribution. Updates for the DCSGS shall be issued after each meeting or upon major graphics configuration changes. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies. Subsequent to the successful review of the DCSGS, the DESIGN-BUILDER shall submit for each facility:

1. One complete set of all WS accessible displays which are unique to this project (i.e., process global, system global, process regional, systems regional, process group, process loop, process component, integrated tutorials, integrated process tutorials, integrated documentation, user assistance). These displays shall be in full size color graphic format and replicate the proposed screen contents. All background colors shall be identical to that of the screen content. All displays shall be arranged in a hierarchical order with references to associated WSs.

2. A system display linkage diagram which defines the hierarchical order and the linkages via page, down, left, right commands.

3. A definition of each displays data fields by tag numbers.

4. A definition of each displays dynamic elements which shall blink, change color, rotate or change shape in response to process changes.

5. A listing of all "help" text associated with each display screen.

6. The software submittal copies shall be numbered, with controlled distribution. Updates for the DCS Software submittal shall be issued periodically or upon major software configuration changes occur as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

H. The DESIGN-BUILDER shall submit the procedures proposed to be followed during the tests required under this project. Procedures shall include statement indicating test objectives, test descriptions, forms, and checklists to be used to control and document the required tests. Prior to the preparation of the detailed test procedures, the DESIGN-BUILDER shall submit outlines of the specific proposed tests. Submittal shall include examples of the proposed forms and checklists. Once the Preliminary Test Procedure Submittal have been reviewed by the CONSTRUCTION MANAGER and returned stamped either "no exceptions noted" or "make corrections noted", the DESIGN-BUILDER shall submit the proposed detailed test procedures, forms, and checklists. Once the detailed Test Procedures Submittal have been reviewed by the CONSTRUCTION MANAGER and returned stamped either "no exceptions noted" or "make corrections noted", the tests may be scheduled. Upon completion of each required test, document the test by submitting a copy of the signed-off test procedures shall be submitted as test documentation. These requirements shall apply to the factory testing of all panels, and all on-site tests. The DESIGN-BUILDER shall submit a detailed ORT specification to the CONSTRUCTION MANAGER at least 6 weeks in advance of commencement of the ORT.

I. Subsequent to the receipt of the OWNER's and CONSTRUCTION MANAGER's inputs made at the pre-submittal conference, the DESIGN-BUILDER shall submit a training plan to cover all training required under this contract. All material shall be in compliance with the requirements of paragraph 3.8. The training shall include:

1. A resubmittal of the material submitted under the proposed training plan with the incorporation of all modifications agreed to at the pre-submittal conference.

2. Schedule of training courses including dates, durations, and locations of each class.

3. Resumes of the instructors who will actually implement the plan.

1.7 OWNERS MANUAL

A. The organization of the preceding shop drawing submittal shall be compatible to eventual inclusion with the Operations & Maintenance Manual submittals for this facility and shall include final alterations reflecting "record" conditions. Submittal not organized as described herein and incomplete submittals for a given Loop shall not be accepted. Accordingly, the initial multiple-copy shop drawing submittal shall be separately bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover, binder suitable for bookshelf storage. Binder ring size shall not exceed 3-inches. Two (2) final sets of technical manuals shall be supplied for the OWNER in accordance with Section 2.5.3.5, "DESIGN-BUILDER Submittal", and one final set shall be supplied for the CONSTRUCTION MANAGER, as a condition of acceptance of the project.

1. Initially, 2 sets of these manuals shall be submitted to the CONSTRUCTION MANAGER for review after return of favorably reviewed shop drawings and data required herein. Following the CONSTRUCTION MANAGER's review, one set will be returned to the DESIGN-BUILDER with comments. The sets shall be revised and/or amended as required and the requisite final sets shall be submitted to the CONSTRUCTION MANAGER 15 days prior to start-up of systems. The CONSTRUCTION MANAGER will distribute the copies.

2. In addition to updated shop drawing information reflecting actual existing conditions, each set of technical manuals shall include installation, connection, operation, troubleshooting, maintenance, and overhaul instructions in complete detail. This shall provide the OWNER with comprehensive information on all systems and all components to enable operation, service, maintenance and repair. Exploded or other detailed views of instruments, assemblies and accessory components shall be included together with complete parts lists and ordering instructions.

3. Repair parts list for each item (as applicable); such lists shall contain the name of each item, purchase order number, model/serial number, and the recommended repair parts to stock, along with the catalog, part, or piece number of each such repair part.

4. Outline dimensional drawings and assembly drawings and the names of the parts.

5. Copies of maintenance specifications, schedules, and instructions.

6. Copies of operation and adjustment instructions for all equipment and components.

7. Processor, peripheral, and data communications equipment instruction, reference, wiring, and option manuals.

8. Software manuals and program source and object listings, annotated in clear English, technically correct flow charts, narrative descriptions, diagnostics, and user's guides. Permanent copies of all programs on magnetic tape/CD / DVD shall be provided for the OWNER's use. Software documentation shall include full instructions on how a program is used, including execution procedures and system software dependency.

9. System test plans and procedures.

10. Simple, English language instructions on how to operate the system through the Workstation (WS).

11. All Operations and Maintenance materials, including shop drawings and the DCS manufacturer's standard DCS manuals and documentation, shall also be submitted in an electronic format. All text files shall be in Microsoft Word for Windows. Electronic data shall be submitted on CDor DVD medium.

1.8 AS-BUILT DRAWINGS

A. As-built drawings shall be prepared in accordance with Section 2.5.3.5 with the following exceptions and changes:

1. The DESIGN-BUILDER shall keep current an approved set of complete DCS loop drawings, PIDs, control descriptions, Input/Output termination lists, control schematics, DCS installation drawings, UPS installation drawings, network conduit and cable routing drawings, and test reports. These drawings shall include all devices furnished under this specification and interfaces with all other devices furnished under this specification and interfaces with all other devices which communicate with the DCS.

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.

1.9 SERVICES OF MANUFACTURER

A. The DESIGN-BUILDER shall provide job site visits and services of a manufacturer's technical field representatives for all equipment which is furnished by others. Job site visits shall occur during the calibration, testing and start-up phase of the project.

1. The DESIGN-BUILDER shall provide the services of competent field technicians to oversee the installation, testing, calibration, start-up, operation and maintenance of the equipment provided under this Section.

2. Provide all necessary assistance to instruct the OWNER's representative in regard to the operation of the equipment supplied. This assistance shall be provided during the start-up phase of the project and the first year of the facility operation following project completion and OWNER acceptance.

1.10 GUARANTEE

A. The DESIGN-BUILDER shall guarantee the WORK of this section.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. After the successful completion the Operational Readiness Testing, and subsequent to the site construction progressing to a point where the intended locations for DCS equipment are complete and free from exposure to on-going construction, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weight shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site. Special instructions for proper field handling, storage, and installation required by the manufacturer for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment.

B. Each component shall be tagged to identify its location, tag number, and function in the system. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment under this Section. Identification shall be prominently displayed on the outside of the package.

1. Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters, including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the DESIGN-BUILDER at their own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such test such as directed by the CONSTRUCTION MANAGER. This shall be at the cost and expense of the DESIGN-BUILDER, or the apparatus shall be replaced by the DESIGN-BUILDER at their own expense.

1.12 QUALITY ASSURANCE

A. The DESIGN-BUILDER shall have instituted a quality assurance program which utilizes organized methodologies and industry standards. All manufacturing, design, development, production, installation, and field service resources of the DESIGN-BUILDER shall be certified as conforming to all of the requirements of international

quality standard ISO 9001. The certification shall be submitted to the CONSTRUCTION MANAGER. This certification shall be a "Certification of Quality", from an internationally recognized certification agency. The program shall include the following aspects at a minimum:

1. System of traceability of manufactured unit and system software throughout development, production and testing.
2. System of "burn-in" for all components and available supportive documents.
3. Demonstrated record of prompt positive response to field failures.
4. Record of prompt shipments in accordance with contract obligations.
5. Documented program of failure analysis.
6. Quality assurance organization which complies with ISO 9001 guidelines.
7. Documented product safety policy relevant to all products intended to be furnished under this Contract.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Current Technology:** All hardware and software shall be the most recent field-proven models and revision levels marketed by their manufacturers at the time of proposal submission. It is the intent of the Owner to obtain a DCS which utilizes state-of-the-art products in the DCS manufacturer's product line. Products within the DCS manufacturer's product line which have been superseded by newer, more advanced devices shall not be acceptable.

B. **Hardware and Software Commonality:** Where there is more than one item of similar equipment, being furnished under this Contract, all such equipment shall be the product of a single manufacturer and feature the interchangeability of parts. Minor deviations from this requirement are acceptable when specific technical requirements impose a deviation in the specifications. In case of a discontinued or upgraded product, or other cases where changing technology requires changes in equipment, the DESIGN-BUILDER shall submit a Substitute Item Request Form. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. This interchangeability shall apply to the following components, as a minimum, of the DCS.

1. Processor Modules
2. Bulk Memory Modules
3. Communication Interface Modules
4. Analog and Discrete Signal Modules
5. Power Supply Modules

C. **Fault Tolerant:** Where a system processor is indicated to be redundant, that unit shall function as a fault tolerant device. Fault tolerant processing shall consist of two parallel-operation processors (electronics) with separate connections to the system communication network. Both processors shall receive and process information simultaneously, with faults detected by the processors themselves. A fault tolerant configuration shall provide synchronous read/execute/compare capabilities with no database transfer. Upon detection of a fault, self-diagnostics shall be run by both processors to determine which processor is defective. The non-defective processor shall then assume communication without affecting normal system operation. Upon

replacement of the defective processor, the operator shall initiate the processor and initiate a command from the workstation to download the database and control logic from the active processor. The operator shall then choose to initiate a transfer to the replaced processor. Alternatively, the download may occur automatically on processor replacement. The use of backup, "hot standby", or "automatic switch over" configurations are acceptable if the transition from failed device to backup device does not degrade the process monitoring and control system or the system's availability.

D. **Environmental Suitability**: All DCS devices provided under this contract shall be provided with enclosures which are suitable for use in a treatment facility environment where there are typically high energy AC fields, DC control pulses, and varying ground potentials between the transducers or process instrument locations and those occupied by DCS components. The system design shall be adequate to provide proper protection against interferences from all such possible situations. As a minimum, all DCS equipment shall be resistive to airborne contaminants commonly found in wastewater treatment facilities, and be suitable for installation in an environment which conforms to a G2 classification as defined by ISA-S71.04.

1. **Field-Situated Equipment**: DCS equipment being furnished under this Contract shall be suitable for use in wastewater treatment facilities, some of which are in an environment of salt-sea laden air with traces of methane and hydrogen sulfide. The system design shall be adequate to provide proper protection against such an environment. All field-situated equipment including PCMs shall be UL-listed or certified by a qualified third-party as meeting UL requirements. All DCS devices shall be housed in an enclosure suitable for its intended service and installation location. All DCS devices to be installed in MCC or other protected areas shall be furnished in NEMA 1 rated enclosures. All DCS devices to be installed in indoor unprotected areas shall be furnished in NEMA 12 rated enclosures. All DCS devices to be installed in indoor areas subject to hose-down conditions, or outdoor areas, shall be furnished in NEMA 4X rated 316 stainless steel enclosures. All DCS devices to be installed in areas where corrosive agents are present in quantities which exceed the warranty limits of the equipment (Headworks, Digesters, Solids Handling, etc) shall be furnished in purged, refrigerated/ air scrubbed NEMA 4X rated 316 stainless steel enclosures. As a minimum, the DCS shall be designed and constructed for satisfactory, long, and low maintenance operation under the following environmental conditions;

   a. Temperature Range: 0 through 50 degrees C (32 through 122 degrees F)

   b. Thermal Shock: 0.55 degrees C (1 degree F per minute maximum)

   c. Relative Humidity: 5 through 95 percent (non-condensing)

2. **Control Room-Situated Equipment**: Each Area control room or central control room will be normally air conditioned to maintain environmental conditions defined herein. No positive control of relative humidity is provided or contemplated. DCS equipment shall meet the following environmental requirements:

   a. PCMs:

      1) Temperature Range: Storage: -40 to 70 degrees C; Operating: 0 to 50 degrees C.

      2) Thermal Shock: 6 degrees C maximum rate of change in 30 minutes.

      3) Relative Humidity: Storage: 0 to 100% non-condensing

      4) Operating: 5 to 95% non-condensing

b. WS

1) Temperature Range: Storage: -40 to 70 degrees C

2) Operating: 0 to 40 degrees C.

3) Thermal Shock: 6 degrees C maximum rate of change in 30 minutes.

4) Relative Humidity: Storage: 5 to 95% non-condensing

5) Operating: 5 to 95% non-condensing

3. **Noise Tolerance:** The DESIGN-BUILDER shall furnish and install sound adsorption materials within/over (i.e., printer covers) DCS equipment enclosures to be installed in those area control centers where DCS devices share work space with personnel to ensure that, with only the DCS equipment operating, the ambient dB level is 55 dB or less when monitored three (3) feet from the operating DCS equipment.

4. **Environmental Operating Range:** All indoor and outdoor enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Control Documents. Heating, cooling, and dehumidifying devices shall be incorporated in order to maintain all devices 20% below their rated environmental operating ranges. The DESIGN-BUILDER shall furnish all internal power wiring for these devices (i.e., heaters, fans, etc.). Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous/classified location in which it is to be installed, and be in conformance with the National Electrical Code (NEC).

5. **Surge and Radio Interference:** All DCS devices shall be IEEE surge withstand qualified. Radio Frequency Protection (RFI) shall conform to SAMA-PMC-33.1.

6. Each PCM shall be provided with an RTD which reports the control room temperature excursions associated with PCM enclosures. For those PCM enclosures which utilize purging, sensors shall be provided which report to the control room to high temperature, low pressure, and "door ajar" conditions. All I/O and sensors associated with enclosure monitoring are to be furnished by the DESIGN-BUILDER.

E. **Equipment Locations:** The DCS configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the OWNER exercises the right to require changes in location of equipment which do not impact material quantities or cause material rework, the DESIGN-BUILDER shall make such changes without extra cost to the OWNER.

F. **Alternative Equipment and Methods:** Equipment or methods requiring redesign of any project details are not acceptable without prior written approval of the CONSTRUCTION MANAGER. Any changes inherent to a proposed alternative, including design modifications, shall be at no additional cost to the OWNER or CONSTRUCTION MANAGER. The required approval shall be obtained by the DESIGN-BUILDER prior to submittal of shop drawings and data. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method specified, or shall include evidence that a specified component is not available.

G. **DCS Project Growth**: All equipment furnished under this Contract will be provided with not only the resources required to meet the function requirements of this project but in addition, all equipment and resources including PCMs; I/O cards; graphic displays; data base; reporting packages; RAM, disks, processor cycle time and memory, etc., shall be provided to accommodate a 20 percent growth in project requirements. All equipment and resources, including but not limited to all costs associated with equipment procurement, equipment testing, system documentation, project management, system engineering, modification to documentation, etc, shall be provided under this contract such that the entire twenty (20) percent project growth can be implemented into the DCS without any additional cost to the OWNER. The 20 percent spare I/O point requirement shall be calculated by rounding calculations down when the fractional I/O point counts are less than 0.5 and rounding up to the nearest integer when fractional points are equal to or exceed 0.5. Fractional I/O card counts shall be rounded up.

H. **DCS Ultimate Project Growth**: In addition to and over-and-above the requirements of paragraph 2.1 G, the entire DCS being furnished under this contract shall be capable of being modularly expanded to accommodate a 100 percent increase in process I/O points, process report/display requirements and manual input requirements. All equipment and resources provided under this Contract shall be able to modularly accept the anticipated future expansion without the need to replace or retire any DCS component or resource. The DCS provided shall be able to incorporate the ultimate system growth without any degradation of monitoring, control, or display response times. As a minimum, all DCS devices shall be sized to accept the DCS ultimate growth (current requirements multiplied by 2.2).

I. **Uninterruptible Power Systems:** All DCS components shall be powered from utility and (except for laser printers) UPS. UPS shall be furnished for DCS components in conformance with the requirements of Section 16611. All UPS for the DCS shall be sized by the DESIGN-BUILDER to furnish a minimum ride-through time of 30 minutes. The DESIGN-BUILDER shall also furnish all wire, conduit, and I/O boards to enable the DCS to monitor the following functions associated with all instrumentation and DCS UPS;

1. Normal Mode
2. Emergency Mode
3. Bypass Mode
4. Low Battery
5. Trouble
6. Alarm

J. **PRIMARY SYSTEM COMPONENTS:** The DCS shall consist of the following primary components;

1. Process Control Modules (PCMs): PCMs shall be directly hardwired to process I/O, intelligent transmitters, and Programmable Logic Controllers (PLCs). All PCMs shall be fault tolerant. PCMs shall receive power from dedicated UPS or, in the event of a failure to the UPS, from the supply power to the UPS. Each PCM shall contain all of the required data acquisition, alarming and control strategies required to monitor and control its associated process. PCMs shall be configured by operator interface devices called Workstations (WS) which utilize object-oriented interactive editors to download database and control configurations over the DCS highway. The failure of any other DCS device shall not affect the monitoring and control capabilities of the PCMs. PCMs shall dual ported to communicate with other DCS devices over the DCS highway. For additional PCM requirements, see paragraph 2.2.

2. Process Inputs/ Outputs (I/O): All process I/O shall be terminated in an enclosure which is proximal or integral with the PCM that is associated with the I/O. All I/O modules shall be IEEE surge withstand qualified with individual A/D and D/A converters on a per-point basis.

   a. If the DCS manufacturer's analog input/analog output I/O boards do not provide A/D and D/A conversion on a per-point basis, or adequate signal isolation, the DESIGN-BUILDER shall:

      1) Furnish spare analog input/analog output or AD/DA boards to conform to the per-point requirement (i.e. if a board has 8 inputs which share an A/D, seven spare analog input boards or seven spare A/D converter boards shall be furnished.

      2) Partition I/O so that the failure of an I/O board will not disable a control strategy. If the implementation of this partitioning results in the need to provide additional analog input/analog output boards, they shall be furnished by the DESIGN-BUILDER at no additional cost to the Owner.

      3) Furnish and install signal isolators on the field side termination assembly of the PCM on a per-point basis.

   b. For additional requirements, see paragraph 2.3.

   c. All I/O shall be optically isolated. Process I/O shall accept the following variations:

      1) Analog Inputs To DCS

         a) Four (4) wire transmitters shall provide an isolated 4 to 20 mA signal.

         b) Two (2) wire transmitters shall provide an isolated 4 to 20 mA signal powered from dc power supplies internal to the DCS.

         c) The DCS shall have a fixed 4-20 ma analog input load of 250 ohms. Provision shall be made to ensure continuity of the loop independent of the DCS equipment status.

      2) Analog Outputs From DCS

         a) Outputs shall be isolated 4 to 20 mA dc signals powered from the DCS

         b) Signal shall be capable of driving a loop impedance of 0 to six hundred (600) ohms or greater.

      3) Discrete Inputs To DCS

         a) Inputs shall be unpowered, isolated contact closures rated at 1A at 24 V dc. Contacts shall be of noble metal or hermetically sealed.

         b) The DCS shall monitor the inputs using internal 24V dc power supplies.

         c) Field contacts for alarms will be wired to discrete inputs in a fail-safe mode; i.e. an open wire will result in an alarm.

4) Discrete Outputs From DCS

a) Outputs shall be unpowered, isolated contacts rated at 5 amps, 120V ac.

b) 120V ac power for sensing all discrete outputs shall be provided external to the DCS.

5) Intelligent Transmitter Interface To DCS

a) Intelligent transmitters shall communicate with the DCS using a bi-directional communication interface.

b) The DCS interface shall enable remote transmitter configuration and simultaneous DCS database updating from a DCS workstation (WS).

d. Programmable Logic Controller (PLC) Interface With DCS

1) The instrumentation panels to be provided under Section 13300 shall be provided with PLC controllers and membrane LED displays in lieu of the specified relays and window-box annunciators.

2) PLCs shall communicate with the DCS using serial communication cables furnished and installed by others. Protocol shall be one of the following:

a) Modbus RTU, with the PLC acting as the slave.

b) Ethernet

3. **Workstations (WS):** WS devices shall be dual ported to the DCS highway to provide the operations staff with an object oriented advanced Graphical User Interface (GUI) used to monitor and intervene in the control of process areas. The sharing of electronics between any type of workstation device (i.e., WSs, PCWSs) is not permitted. Each workstation device shall be stand-alone. Each WS shall serve as a device which shall have all the utilities required to perform network management and system configuration functions (i.e. database, control strategies, process graphics, report formats, trends, x-y plots, alarm reports, etc). The WSs and Servers shall be provided with Remote Desktop software (for Windows-to-Windows connectivity) and with rDesktop software (for Solaris-to-Windows connectivity), as required. All appropriate Remote Desktop software licenses shall be provided with the terminal server hosts by the DESIGN-BUILDER. WS devices shall also be ported to the Department Information Network (DIN) which provides:

a. Communicate with the DIN to support WS information requests and to service requests from other DIN/DCS highway connected devices. This interconnectivity shall enable all WS, independent of their physical locations, to access all information which is available to another WS. All WS functionality shall be regulated by password authorization. Each WS shall interface with the various networks using the Remote Desktop and rDesktop applications provided. For additional WS requirements, see paragraph 2.5.

4. **DCS highway**: The DCS highway shall consist of communications processors and fiber optic cables all of shall be dual ported into all connected DCS devices. The DCS highway, in its installed configuration shall be fault tolerant. The DCS highway provides connectivity between the WSs, servers, PCMs, and the Historian System (HS) to enable the timely update and archiving of process information and timely control response. For additional DCS highway requirements, see paragraph 2.4.

5. **Redundant Historian System (HS):** The HS shall consist of a fault tolerant processor, each with mass storage modules, data management and reporting software, and peripheral devices needed to support and maintain the HS. The HS shall be dual ported into the DCS highway in a fault tolerant manner. Additionally, the HS shall be ported into the DIN to provide connectivity with DIN devices. For additional HS requirements, see paragraph 2.10.

6. Reserved.

7. **Department Information Network (DIN):** The DIN shall provide connectivity between the all Department facilities and resources by virtue of a network which incorporates high-speed fiber, and telephone data links and radio technology. For additional DIN requirements, see paragraph 2.4.

2.2 PROCESS CONTROL MODULES

A. **General**: The PCM shall be a 32 bit microprocessor with on-board random access memory (RAM) for read/write functions. The PCM, in conjunction with field Input/Output (I/O) modules shall perform all system data acquisition, alarm detection, regulatory, logic, timing and sequential process control. PCMs shall perform continuous control, sequential control, and data acquisition concurrently in the same microprocessor. PCMs shall communicate with the Historian System (HS), Workstations (WS) over the DCS highway. All PCMs shall be fault tolerant and be provided with the implemented built-in capability to provide continued correct execution in the presence of the failure of a common logic board or software faults. Failover from one processor to another shall occur within 1000 ms. Each PCM shall be supplied to provide complete redundancy (excluding I/O) configured for fault tolerant processing via standard system configuration procedures. Fault tolerant features shall each include, but not be limited to, control processors, power supplies, wiring and buses. PCM's shall be remotely configurable from WSs over the DCS highway. Each PCM shall have the capacity to accommodate a minimum of 2000 field-originated I/O points, without requiring additional memory or processors, assuming a mix of 25% analog I/O and 75% discrete I/O, with 50% of memory reserved for control logic

B. **Communications:** PCM's shall communicate with each other directly in a peer-to-peer manner using peer protocol or logical link protocol in which the sequence of message exchanges between two entities in the same layer is facilitated by utilizing the services of underlying layers to effect the successful transfer of data/control information from one location to another location.

C. **PCM Functionality:** Independent of the operation or failure of any other DCS device, the PCM shall perform the following core or essential functions;

1. Real-time data acquisition at scan rates specified at the WSs.

2. Perform input signal smoothing, averaging, or totalization, as required.

3. Alarm limit checking for absolute limits, deviation rates, or warning limits on designated variables.

4. Real-time process control based on logic and control strategies downloaded from the WSs to the PCM's over the DCS highway.

5. Communicate variable data information (i.e., current value, alarm status, set point, output control constants, etc.) to the HS and WSs.

6. Communicate with all other system processors regardless of their function without the need for hardware or software gateways. Respond to interrogations for data and receive downloaded operating system, processing records, point data base information and updated parameters for application programs operating in the PCM.

7. Perform regulatory, logic and sequential control based on configuration data written in a high level process oriented control language, compiled, and downloaded to the PCM.

8. Have an extensive array of self-diagnostics which test and report on the integrity of each printed circuit board in the common logic file in addition to I/O failures. Errors and/or failures shall be indicated locally by Light Emitting Diode (LED) and reported at the WSs.

9. The PCM shall function as a stand-alone unit which performs all of the functions described herein completely independent from the functioning of the HS device, WSs, the DCS highway, bridges, routers or other PCMs, i.e., a failure. Any device furnished under this section or other PCM(s) shall not impact data acquisition, control, scaling, alarm checking, or communication functions of a given PCM.

D. **PCM Hardware Component Platform**: Each PCMs hardware platform shall use fully redundant Intel or Intel-compatible microprocessors, each with its own bus connection. No hard disks or other moving parts shall be used. The PCM shall consist of the following components:

1. **Microprocessor Unit**: The microprocessor CPU shall conform to the following:

   a. Intel-compatible 32 BIT processor, 400 MHz or faster

   b. Floating point processor.

   c. Crystal controlled real time clock.

   d. Power fail/auto restart.

   e. Watch dog timer protection (hardware or API).

   f. Redundant isolated power supplies (may be shared with I/O)

   g. Serial interface to process I/O.

   h. Priority interrupt driven.

2. **Memory**: CPU memory shall be on-board and shall conform to the following:

   a. CMOS shared RAM memory with battery backup. After the configuration of all database and control strategies which incorporate the current I/O quantities plus the 20 percent growth required under 2.1 G, each PCM shall have 25 percent of its memory which is dedicated to (1) the storage of database and control strategies and (2) field I/O termination points unused with both resources available for future expansion. Requirements for spare memory capacity may be, on approval by the Owner, applied on a Facility basis.

   b. Cache memory which is positioned between the CPU and the bus which maintains a copy of referenced data from the shared memory.

   c. CMOS-ROM or EPROM in which firmware and the operating system resides.

3. RESERVED

2.3 PROCESS INPUTS/OUTPUTS (I/O)

A. General: Process I/O modules shall be rack mounted or DIN rail-mounted in an enclosure which is proximal or integral to/with the associated PCM. All process I/O boards shall be slot independent i.e. any I/O card can occupy any card slot. The backplane of the I/O nest shall permit the removal of I/O cards without the need to remove power from the I/O card being removed. All process I/O channels shall be electrically isolated (input isolated, output isolated, and power isolated) from field terminations and adjacent channels as defined in ISA-S50.1.

B. All I/O boards shall conform to ANSI/IEEE C37.90-1989 for surge withstand capability and EN50082-2 for electromagnetic compatibility immunity.

C. Analog input boards shall provide 120 dB at 50 or 60 Hz and 60 dB common mode and normal mode noise rejection respectively. Analog Input boards shall have an on-board isolation of 500 DCV pr peak ac between channels or channel to ground.

D. Analog input boards or modules shall be provided to interface with process I/O and intelligent transmitters as follows;

1. Analog input boards shall be provided to accept 4-20 mA, pulse frequency, and thermocouple (Type K, T, J, R, and S) inputs. Through board level jumper selection on a point-by-point basis, the analog input channel can act as either source (for two wire transmitters) or sink (four wire transmitters). Each analog input shall have a minimum of 12-bit resolution, minimum accuracy of plus or minus 0.1 percent, maximum long-term drift of 0.02 percent, and a dedicated A/D converter.

2. Intelligent transmitter modules (ITMs) which allow receiving continuous self-diagnostic data shall be provided. The reading of transmitter data or value shall not disturb or interfere with the reading of the measurement signal.

a. Intelligent process instrumentation shall be directly connected to the DCS through a bi-directional digital communication interface at the PCM. Analog transmission of variables from intelligent transmitters shall not be acceptable.

b. Each ITM shall contain a minimum of six (6) individual channels, each of which provides isolated power and communication to the intelligent device. All digital communication with the intelligent process instrumentation from the DCS WS shall be in engineering units and shall be received a minimum of ten (10) times per second. Each message shall contain the following;

1) Primary measurement information such as flow, pressure, level, etc.

2) Transmitter temperature readings in a 32 bit floating point format which complies with IEEE.

3) Data security information

4) Diagnostic information

5) Message checking

c. Information (when available from the field instrument), which shall be displayable at any DCS WS, shall include:

1) The assignment of configurable parameters such as tag number, location, address, tag name, designation of digital or 4 to 20 mA output, upper and lower range values, zero elevation or suppression, linear or square root output for d/p cells, and damping time.

2) Perform a loop integrity check.

3) Rearrange without using calibrating input pressure.

4) Display the 4 to 20 mA signal in terms of percent of span, or engineering units.

5) Last calibration date.

6) Fail-safe direction.

7) Read process variables in user selected engineering units.

8) Diagnose problems and determine fault between processor or transmitter.

d. All ITMs shall be slot independent. ITM operation shall not be impacted in the event that one of a pair of fault tolerant PCM processor fails.

e. The transmitter bus provided shall where indicated provide ISA SP50, or ISP (InterOperable Systems Project) connectivity.

f. In addition to ISA SP 50 and ISP conformity, all ITM devices shall be furnished to communicate with devices which use the HART protocol.

E. Analog output boards shall be provided to output 4-20 mA commands. Each analog output shall have a minimum of 12-bit resolution, accuracy of 0.1 percent of full scale, and a dedicated D/A converter.

F. Discrete input boards shall be of the voltage monitoring type and shall be powered by the PCM. The discrete input board shall accept 24 V dc.

G. Discrete output boards shall be unpowered isolated contacts rated for 5 amps at 120 V ac.

H. PLCs shall interface to the DCS through a foreign processor interface (FPI) which is defined as follows;

1. The DCS shall be provided with an integrated foreign processor interface (FPI) in the PCM which supports monitoring and control of the PLC. The FPI shall support the following protocols: MODBUS (master), Allen-Bradley DF1. The FPI shall be fault-tolerant and redundant where indicated.

2. The DCS shall have an open architecture which shall enable the FPI to provide a means of integration of with multiple vendors in a manner which is transparent to the user at the WS level. All of the data associated with the FPI shall appear at the WS as being identical in format and presentation to data derived from PCMs. All WS interaction functions that the operator uses to monitor and control inputs/outputs associated with the PLC(s) shall be identical as those used by the operator to interact with inputs / outputs associated with the PCM(s).

3. The FPI shall be provided to interface with all PLCs which provide inputs/outputs to the DCS.

4. The FPI shall support the following functions;

a. PLC-derived data shall appear identical to PCM-derived data in the process I/O data base for PCM-to PCM communications.

b. The ability to have closely-coupled continuous and sequential control strategies which involve PCM and PLC coordination.

2.4 COMMUNICATION SYSTEMS

A. **General:** Data communication subsystems shall be comprised of industrial grade redundant communication buses that provide high speed data transmission between all distributed processors and I/O modules. Each communication network shall be designed around the International Standards Organization's Open System Interconnection (OSI) model, IEEE 802 or ANSI X3T12 industry standards and support a hierarchical communications network. Communications shall be masterless with communications residing in each distributed processor. All communication cables shall be installed in conduits. The DESIGN-BUILDER shall review the Contract Drawings to review the current communications system design. The DESIGN-BUILDER shall furnish all cable required to accommodate the communications system being provided. The DCS highway shall be a single Fast Ethernet network, provided that the DCS highway real-time data uses synchronous mode transmission.

B. **Low-Level Protocols**: Physical and data link layer protocols shall support local area networks (LANs), metropolitan area networks or wide area networks (WANs). Information shall be conveyed in packets with a sustained signaling rate of at least 100 million bits per second.

C. **Mid-Level Protocols**: Network and transport layer protocols shall provide addressing and routing facilities to enable a host on one network to send a block of information to host located on another network thereby expanding a host's communication environment from a single network to a network of networks, or an Ethernet, joining addressable hosts. Mid-level protocols shall support the implementation of half-gateways i.e., LAN - backbone coupling and full gateways i.e., LAN-LAN couplings. Node-node gateways shall perform protocol translation and if necessary implement virtual circuits where required. For those applications which access the network layer directly, a programming interface shall be implemented in the packet network to facilitate the use of datagrams i.e., blocks of information embedded within single packets which can be sent to individual hosts without using additional protocol software.

D. **High-Level Protocols**: The Session, Presentation, and Application Layers shall use the transport mechanism provided by the Mid-Level Protocols to implement a distributed computational environment. Session Layer services shall augment the virtual circuit facilities present at the Transport Layer. The Presentation Layer shall regulate the representation of data items conveyed across the network. Support for the ONC (Open Network Computing) product suite (i.e. XDR, RPC, NIS, NIS+), BSD sockets, SYS V streams shall be provided.

E. **DCS highway**: The DESIGN-BUILDER shall furnish and oversee the installation of a DCS highway which shall connect all DCS and information system devices in a manner which creates an environment in which applications on distinct devices shall accomplish work cooperatively by sharing information as well as synchronizing the operation of the two applications of a common task. The DCS highway shall be the DCS manufacturer's standard and most secure offering for a process control network, and shall use a physical star and/or Fast Ethernet topology. The DCS highway shall conform to the following;

1. Each DCS and information system device shall be furnished with a DCS highway communication device, complete with detailed device command algorithms encoded as processor instructions, to manage the device/controller interface.

2. The DCS highway shall be able to support the system response times stated in paragraph 2.5 with a database sized in conformance with 2.1 H (i.e. 220% of the current database).

3. The DCS highway shall utilize redundant fiber optic cables between structures. Within structures, Category 5e/6 unshielded twisted pair cable (UTP) may be used, provided that levels of induced electrical noise do not interfere with data transmission. The cables shall be furnished and installed by the DESIGN-BUILDER.

4. The DESIGN-BUILDER shall review the Contract Documents to determine if the conduit system meets the DCS manufacturer's requirements, determine the exact length requirements and to compare the tensile strength associated with the cable to be provided with the handhole/pullbox spacing indicated in the Contract Documents. If additional handholes/pullboxes are needed to accommodate the characteristics of the DESIGN-BUILDER'S cable, they shall be furnished by the DESIGN-BUILDER at no expense to the OWNER. The DCS highway shall utilize a medium which as a minimum conforms to the following:

   a. Industrial grade, water resistant optic fiber, coated with a suitable material to preserve the intrinsic strength of the glass, suitable for installation in conduits which are encased/directly buried/ cable trays.

   b. Cable of all dielectric construction.

   c. Multi-mode, graded index, solid glass waveguides with the following characteristics:

      - Nominal core diameter 62.5 microns
      - Minimum ellipicity 2.0 percent
      - Outside clad diameter 125.0 microns
      - Maximum Numerical Aperture (NA) 0.275
      - Maximum attenuation (850) 3.75 dB/Km
      - Maximum attenuation (1,300) 1.5 dB/Km

   d. Each fiber continuous with no factory splices.

   e. Tight buffer.

   f. Fast Ethernet compatible.

   g. Drop cables shall be of variable lengths of flexible fiber optic cable, typically not to exceed 400 feet so that loss in the drop cable is less than 1 dB. This length of drop cable shall permit relative freedom in routing the trunk cable and locating the station.

F. Reserved.

G. **Department Information Network (DIN):** The intent of these Contract Documents is to conceptually describe the desired level of functionality and key criteria associated with the DIN.

1. **DIN CONCEPTS:** The DIN shall interconnect with the DCS highways associated with North City Water Reclamation Plant (NCWRP), Metropolitan Biosolids Center (MBC), Point Loma Wastewater Treatment Plant (PLWTP), and the South Bay Water Reclamation Plant (SBWRP). This interconnection shall utilize a multi-stranded single-mode fiber optic One Gigabit Ethernet data communication link between all facilities.

2. Designated WSs at each facility shall be able to access all process displays at any other facility via Remote X-windows, Remote Desktop, rDesktop, or Exceed, as applicable. Serial data transport within the DIN to the existing Ovation system at COMC shall be configured for selected real-time and calculated process data to be placed onto the COMC DCS highway for display and control.

3. **DIN Design Criteria:** The DIN shall provide a service backbone network for the Department. At the COMC control room at MOC 2, the WSs located in the Department Headquarters shall have the capability of the following;

   a. Dynamically view any WS process display screen associated with the selected facility connected to the DIN.

   b. View all displays associated every facilities' DCS highway resources. This shall include dynamically linking into MMS, MIS, LIMS, etc data associated with the selected facility.

   c. View current and historical data associated with the DCS highway resources at any facility.

   d. Receive, in a dynamic manner, all high priority alarms associated with any facility.

   e. Generate overview process reports based on data extracted from each plants historical database. Reports shall be generated on a daily, weekly, monthly and annual basis.

   f. Generate overview reports based on data extracted from each plant's DCS highway database, such as management / maintenance / laboratory / process data. Reports shall be generated on a daily, weekly, monthly and annual basis.

   g. Receive a selected set of real-time process data at COMC and alarms for display on an inter-facility overview graphic. A total of 100 digital I/O and 50 analog points shall be implemented.

2.5 WORKSTATIONS (WS)

A. **General**: Each WS platform shall feature graphics, multitasking with preemptive priority scheduling and virtual memory to enable concurrent processing without degradation of response times required for critical tasks, and networking capabilities that enable the workstations to run sophisticated applications and bridge the gap between various MIS functions and the process. WSs shall function as a stand alone process control and system configuration device. Each WS shall have the resources to assist in maintaining an integrated facility-wide, department-wide, and community-wide database. WSs shall present a windowed, high resolution, color-graphic interface to the operator in the depiction of present and past values of process.

B. **WS Functionality**: The DCS shall be provided with WSs that provide an engineering interface to the control system. The WS shall be designed to function as a workstation for process control and instrumentation engineers. The WS interface shall operate in both a (1) fill-in-the blanks mode wherein the user interacts through an interactive prompt and response sequence and (2) a graphics-oriented mode wherein the user implements control logic & CRT based graphics by physically drawing configurations and schematics on the screen. The WS shall have inherent pan and zoom features which enable the display of control schemes, logic and displays which exceed the spatial constraints of a CRT screen. Each WS shall be configured to be universal in scope (e.g. has access to all system displays and data). Each WS shall have a password security system to prevent the unauthorized access of system configuration activities. The security system shall be comprised of at least 12 layers of prescribed access with associated authority. While the

WS is in a configuration mode, all data entered shall be subject to reasonableness and validity checks. If an invalid/unreasonable input has been made, the engineering interface shall detect the condition and provide prompts or help facilities.

C. **WS Display Response Times**: The interactive shared display system coupled with the data communication networks described herein shall perform in accordance with the following response dynamics:

1. Steady state displays shall display data which is no more than one (1) second old.
2. The time between an Operator manipulation and a reaction at the final control element shall not exceed 2 seconds.
3. The elapsed time from when the Operator requests a new display to a display being presented shall not exceed 1 second.
4. These times do not apply to Remote Desktop and rDesktop WS sessions.

D. **Operator Interaction**: The Operator shall be provided with a means of interacting with the various displays which assist monitoring (overviews), permit control intervention (groups), provide parameter review and adjustment (detail), are predictive (trends) and assist the Operator in diagnostics (alarms, schematics, menus). The Operator shall interact with these displays, order changes in values, and modify configurations in a man-machine conversational mode via the following two interfaces: track ball or mouse, standard keyboard. The entry device shall be integrated with the man-machine design structure to enable a minimum amount of key strokes in common operations such as "Alarm Acknowledge" and "On/Off", "Fast/Slow" manipulations. Long strings of alphanumeric coded entries via buttons are unacceptable for process operating procedures.

E. **WS Hardware Component Platform**: Each WS hardware platform shall utilize Intel microprocessor chipsets with integrated mass storage and communication devices to enable independent stand-alone operation. All hardware platforms which comprise the DCS shall exhibit object code compatibility in that the same object code can be executed on all hardware platform implementations without the need to recompile, re-link, or change formats. The following WS hardware and software requirements present **minimum** requirements. The DESIGN-BUILDER shall furnish all additional resources required to meet the requirements of these specification.

1. An Intel® Pentium® Dual Core Processor CPU, 2.0 GHz or faster.
2. PCI bus.
3. A 19-inch LCD Color Monitor:
   a. 1152x900 @ 66Hz, 76Hz , 1280x1024 @ 67Hz, 76Hz,1600x1200 @ 75Hz
4. Total of 1 GB ECC 667MHz DDR2 SDRAM on the motherboard, with a maximum capacity of 8 GB.
5. An 80 GB (1 x 80 GB) 7200 rpm SATA Disk.
6. One CD-RW/DVD-ROM Combo Drive
7. One graphics accelerator card.
8. Fast Ethernet port(s).
9. Two full height PCI slots, 1 PCI-E slot
10. Keyboard and trackball or mouse.
11. Engineer/Operator WS: Dell OptiPlex GX755 mini-tower, or equal.

F. **WS Operating System (OS) Software**: The OS shall comply with the requirements of paragraph 2.15.

G. **WS Database Management System (DBMS)**: Each WS shall have its own Real-Time Data Base (RTDB) that reflects the current state of all process variables. All real time process data shall be available to any WS connected to the DCS highway.

H. **WS Tools Platforms (TP)**: The TP shall extend the functionality of the OS by providing application tools or extensions of the OS platform. The TP shall provide, through a procedural call interface, software to support:

1. User-operating system interface (command prompt) to allow the user to manipulate files and run application programs in a concurrent manner.
2. Database management systems (DBMS) which employ Structured Query Language (SQL) interface to a relational database. Command prompt environment variables to support SQL shall be configured for Oracle.
3. Multimedia input/output to mass storage i.e., raid arrays using mapped files and special storage device drivers incorporated into the OS platform.

I. **WS Standards Compliance**: The following standards shall apply to maximize the interoperability and connectivity of the system and to provide object code compatibility between all hardware platforms used on this project:

1. Floating point processor shall comply with IEEE-754.
2. Network communications shall comply with IEEE-802.3/802.4.
3. Peripheral interface shall comply with Ultra-SCSI or USB.
4. Compatible with network protocols TCP/IP.
5. User interface based on Microsoft Windows.

2.6 PERSONAL COMPUTER (PCWS) WORKSTATION

A. **General:** Where indicated, PCWSs shall be utilized as an interface device to access DCS highway or DIN data. Trackball or mouse devices shall be the primary operator input devices, with keyboards as the supplementary input device. All PCWSs shall be functionally interchangeable and identical in display arrangements, menu selections, command terminology, and data access methods. All PCs shall be capable of accessing both typical operator process control functions and engineering configuration functions, through configurable software modes using Remote Desktop. PCWS functional modes shall be password protected for system security and user identification.

B. Each PCWS shall consist of individual electronics (i.e., PCWS electronics shall NOT be shared amongst more than one PCWS) to support one 19-inch high resolution LCD, network communications and utilize a password-protected resource configuration mode for high level system and control configuration. PCWSs shall function with equal process monitoring and manipulation capability, thereby giving complete flexibility for password-protection of configuration and assignment of displays and software modes for a given situation.

C. Each PCWS shall be as follows:

1. RESERVED.
2. A motherboard with 32-bit bus width using PCI.
3. An Intel Core duo processor CPU, 2.66 GHz or faster.

4. 2 GB SDRAM
5. 3 Universal Serial Bus (USB) ports
6. Minimum 400 GB EIDE hard drive, with 7200 or higher spindle speed.
7. RESERVED
8. Four expansion slots: 2 PCI, 2 PCI express
9. A 19-inch LCD monitor with 128 MB graphic/video card, NVIDIA GeForce 7350LE or equal
10. A combination Ethernet/Fast Ethernet TP network interface card
11. A PC compatible mouse, Microsoft or equal
12. A 20 - speed CD ROM/ 10X Re-Writable (CDR/CDRW) drive
13. RESERVED
14. A keyboard
15. A tower case with dual fans and 300+ watt power supply, FCC Class B certified
16. Preloaded Microsoft Windows XP Professional, Microsoft Office (latest version).

2.7 DOMAIN CONTROLLER DATABASE SERVER (DCDS)

A. **General**: The DCS shall be provided with a Domain Controller Database Server(s) to assist in the overall functionality of the DCS. The DESIGN-BUILDER shall provide the DCDS with enough system hardware resources, configuration, software applications, etc., to meet the overall DCS performance requirements.

B. **DCDS Hardware Component Platform**: Each DCDS hardware platform shall utilize Intel microprocessor chipsets with integrated mass storage and communication devices to enable independent stand-alone operation. The following DCDS hardware and software requirements present **minimum** requirements. The DESIGN-BUILDER shall furnish all additional resources required to meet the requirements of these specifications.

1. A Single Dual-Core Intel® Xeon® 3060 CPU, 2.4 GHz or faster.
2. PCI bus.
3. A 19-inch LCD Color Monitor:
   a. 1152x900 @ 66Hz, 76Hz , 1280x1024 @ 67Hz, 76Hz,1600x1200 @ 75Hz
4. Total of 1 GB ECC 667MHz DDR2 SDRAM on the motherboard, with a maximum capacity of 8 GB.
5. 2 x 73GB SAS Hard Disk Drives.
6. RD1000 Internal SATA Hard Disk Drive with 120GB Removable Hard Disk Cartridge.
7. One DVD-ROM/CD-RW IDE Combo Drive
8. One graphics accelerator card.
9. Two Fast Ethernet NICs
10. Two full height PCI slots, 1 PCI-E slot
11. USB Keyboard and trackball or mouse.

13. Domain Controller Database Server: Dell PowerEdge 840 Server, or equal.

C. **DCDS Operating System (OS) Software**: The DCDS shall be provided with Windows 2003 Server R2. In addition, the OS shall comply with the applicable requirements of paragraph 2.15.

2.8 TERMINAL SERVER HOSTS (TSH)

A. **General**: The DCS shall be provided with a Terminal Server Host(s) to assist in the overall functionality of the DCS. The DESIGN-BUILDER shall provide the TSH with enough system hardware resources, configuration, software applications, etc., to meet the overall DCS performance requirements.

B. **DCDS Hardware Component Platform**: Each TSH hardware platform shall utilize Intel microprocessor chipsets with integrated mass storage and communication devices to enable independent stand-alone operation. The following TSH hardware and software requirements present **minimum** requirements. The DESIGN-BUILDER shall furnish all additional resources required to meet the requirements of these specifications.

1. Single Dual-Core Intel® Xeon® 3060 CPU, 2.4 GHz or faster.
2. PCI bus.
3. A 19-inch LCD Color Monitor:
   a. 1152x900 @ 66Hz, 76Hz , 1280x1024 @ 67Hz, 76Hz,1600x1200 @ 75Hz
4. Total of 2 GB ECC 667MHz DDR2 SDRAM on the motherboard, with a maximum capacity of 8 GB.
5. 2 x 73GB SAS Hard Disk Drives.
6. One DVD-ROM/CD-RW IDE Combo Drive
7. One graphics accelerator card.
8. Two Fast Ethernet NICs
9. Two full height PCI slots, 1 PCI-E slot
10. USB Keyboard and trackball or mouse.
11. Terminal Server Host: Dell PowerEdge 840 Server, or equal.

C. **TSH Operating System (OS) Software**: The TSH shall be provided with Windows 2003 Server R2. In addition, the OS shall comply with the applicable requirements of paragraph 2.15.

2.9 VIRUS PROTECTION SYSTEM (VPS)

A. **General**: The DESIGN-BUILDER shall provide a virus protection system for the Windows based DCS being provided by the DESIGN-BUILDER. The VPS shall include but not be limited to software application(s), server(s), cables, licenses, etc. The virus protection system shall be stand alone and monitor the health and integrity of the WSs, Servers, and DCS highway. There shall be no Ovation software loaded on the VPS. The VPS shall be ported directly to the communication/network hardware. The application run times shall be engineer configurable and adjustable. Virus protection updates shall be performed manually. The virus run times shall be engineer selectable to be performed hourly, daily, weekly, or monthly.

B. **VPS Hardware Component Platform**: Each VPS hardware platform shall utilize Intel microprocessor chipsets with integrated mass storage and communication devices to enable independent stand-alone operation. The following VPS hardware and software requirements present **minimum** requirements. The DESIGN-BUILDER shall furnish all additional resources required to meet the requirements of these specifications.

1. Intel® Pentium® Dual Core Processor CPU, 2.0 GHz or faster.
2. PCI bus.
3. A 19-inch LCD Color Monitor:
   a. 1152x900 @ 66Hz, 76Hz , 1280x1024 @ 67Hz, 76Hz,1600x1200 @ 75Hz
4. Total of 1 GB ECC 667MHz DDR2 SDRAM on the motherboard, with a maximum capacity of 8 GB.
5. 80 GB Hard Disk Drive.
6. One DVD-ROM/CD-RW IDE Combo Drive.
7. One graphics accelerator card.
8. One Fast Ethernet NIC.
9. Two full height PCI slots, 1 PCI-E slot
10. USB Keyboard and trackball or mouse.
11. Virus Protection System: Dell OptiPlex GX755 mini-tower, or equal.

C. **VPS Operating System (OS) Software**: The VPS shall be provided with Microsoft Windows XP Pro. In addition, the OS shall comply with the applicable requirements of paragraph 2.15.

2.10 HISTORIAN SYSTEM

A. **General:** The Historian System (HS) shall consist of a set of fault tolerant microprocessor computers which executes computation intensive file server functions to support system and historical data management functions. The DESIGN-BUILDER shall provide redundant "scanners" to log real time process data for each HS provided. The "scanner" data collected shall be written to the HS hard disk and also to the RAID array. The HS shall have all its subsystems monitored for health and alarmed if faults occur. The HS shall:

1. Communicate with internal electronics over the DCS highway network with all system processors to execute requests of bulk storage file data.
2. Collect performance statistics, perform processor reloads, provide message broadcasting, handle all processor alarms and messages, and maintain consistent time and date information in all system processors.
3. Maintain a process information data base to support historical data storage, retrieval operations, report/log generation, trending, event reconstruction, operator "help" and system electronic documentation.
4. Maintains an on-line plant-wide historical database which contains the following:
   a. Analog values on change in excess of a settable dead band.
   b. Digital points on change of state.
   c. Operator event messages (operator actions)

d. Alarm messages

e. Point attributes

f. Sequence of Event (SOE) messages

g. File/report storage

5. Data Storage: Either of the following shall be provided:

a. A contemporary database consisting of the most recent 90 days of 6 second averages of all analog and calculated values.

1) This storage segment shall be sized on the basis of accommodating a number of variables equal to twice the number of analog inputs associated with this project. After data is over 90 days old, data shall automatically compressed into the storage of hourly averages and daily averages. This compressed data shall be stored on line for a minimum period of 2 years. Subsequent to the expiration of the 2 year period, data shall be archived to a RAID array. Adequate resources shall be provided to archive a total of 2 years of data, minimum.

2) An alarm and event database which retains discrete occurrences with timestamps for a period of one year. This storage segment shall be sized on the basis of 1/100th of the number of discrete inputs associated with this project being stored each minute. Subsequent to the expiration of the one year period, data shall be archived to a RAID array. Adequate resources shall be provided to archive a total of one year of data, minimum.

b. Alternatively, all specified data may be stored and compression/averaging done during retrieval. Data shall be backed up to the RAID array on a daily basis. Digital values shall be stored, at a minimum, whenever a change of state occurs, and analog data stored whenever a change in its value exceeds a specified dead band. Sufficient fixed-disk space shall be provided to store 1000 analog points and 3000 digital points for 400 days, with the following assumptions:

1) Each stored analog point exceeds dead bands 5 times per minute.

2) Each stored digital point changes state once every 100 minutes.

3) Point attributes are saved once per week

4) A total of 7000 operator event messages

5) A total of 3500 alarm messages

6) A total of 1400 SOE messages

7) File/report storage is not included.

6. A report database shall be maintained by the retaining of all reports generated during a 13 month period. The recall of these reports from memory shall not require the recompiling of report data. At the user's option, all report data may also be copied to the RAID array.

B. **Types**: The HS shall be a redundant Emerson Ovation Process Historian.

C. **Historian Hardware:** The DESIGN-BUILDER shall furnish all necessary interconnecting cables, accessories and appurtenances as well as additional processor or peripheral hardware as required for proper operation of the HS and to meet the functional requirements specified herein or indicated on the Drawings. The HS processor shall be physically and functionally independent of other system processors, as indicated on the Drawings. All major HS components and peripheral devices shall be of the same DCS manufacturer. The HS processor shall be capable of tolerating and riding through a power interruption of 100 milliseconds or less without interruption of normal operation. The HS processor and peripherals shall be housed in a separate enclosure using a self-supporting mounting structure and shall not share any common components or devices with other processors.

1. An Intel® 2.13GHz Xeon® or 2.4GHz Core 2 Duo® E4600 CPU, 2.0 GHz or faster.
2. PCI bus.
3. A 19-inch LCD Color Monitor:
   a. 1152x900 @ 66Hz, 76Hz , 1280x1024 @ 67Hz, 76Hz,1600x1200 @ 75Hz
4. Total of 1 GB ECC 667MHz DDR2 SDRAM on the motherboard, with a maximum capacity of 8 GB.
5. 3 x 146GB SAS hard disk drives.
6. 48x CDROM Drive.
7. One graphics accelerator card.
8. Two Fast Ethernet NICs.
9. Two full height PCI slots, 1 PCI-E slot
10. USB Keyboard and trackball or mouse.
11. 56K Modem
12. The Historian CPU shall have the capacity to support all supplied software for the system without utilizing more than 50 percent of its processing capability during any 60 second interval. The spare processing capacity is required for future expansion of the system. The DESIGN-BUILDER shall submit verification of this design requirement during the submittal phase of the project.
13. In addition to the HS having adequate storage and processing resources to support all specified software and system functionality, the HS shall be provided with a minimum of 50 percent spare processing and memory resources.
14. Historian Server: Dell PowerEdge 840 Server, or equal.

D. **Main Memory:** The CPU shall be provided with solid-state memory sized to meet the maximum operating requirements of the system as supplied, and shall include at least 100 percent spare capacity. Spare capacity must be completely free and available for the Owner's use at the time of final acceptance. The main memory supplied with the system shall be modularly expandable beyond that delivered with the initial system. It shall be possible to expand the main memory storage to **four** times that required by the initial system without requiring major software modification.

E. **Long Term Storage:** The HS shall include system resources to provide adequate long term data storage. Additional disk drives shall be provided as required to meet capacity requirements.

1. The HS shall be provided with fixed hard disk drives to store all system software, database information, and run-time data.
2. The HS shall also include one RAID array system for long term historical data storage. The RAID array shall receive historical data from the hard disk drive and shall meet the following requirements:
    a. Capacity up to 307 GB
    b. Cache memory: 128 MB
    c. Expansion: SCSI Daisy Chain
    d. Supports multiple RAID arrays.
    e. RAID levels: 0, 1, 0 + 1, 3, and 5.
    f. Data transfer rates: 160 MB / second per channel.
    g. Disk tray, fan and power supplies shall be hot swappable.
    h. Type: Raid Web Indy 2231 SCSI IDE Rack mount RAID, or equal
3. Each media storage device shall incorporate parity or error-detecting code generation and checking. Detected errors shall be either corrected automatically or reported by HS system management software for software action. RAID array shall automatically detect bad array sectors and failing disk drives before data is affected.

F. **Historian Operating System (OS) Software**: The HS shall be provided with Windows 2003 Server R2. In addition, the OS shall comply with the requirements of paragraph 2.15.

G. **HS Communication Software:** The Historian/Log Server shall use the DCS highway for communications and printing tasks.

H. **HS Data Connectivity:** All of the HS data bases shall be SQL and OLE compliant, minimum. Ability to read data from standard data base applications such as Microsoft Excel, Access, and Applix Data over the DCS highway shall be provided and demonstrated. Ovation API over the DCS highway shall be provided and demonstrated.

2.11 PERIPHERAL DEVICES

A. **General:** A peripheral device processor or internal printer server shall be provided to translate messages from other processor stations on the network into device specific messages. The processor shall provide the interface to hard copy output devices within the system and other terminal I/O devices.

B. **Peripheral Servers:** Peripheral servers, such as printer servers, shall enable 32-bit device network access to the DCS highway from any DCS highway-attached workstation. Server software drivers shall be supported by the network operating system, and all application software attached through a peripheral server shall use operating system services for peripheral access. Log/report printers shall be provided with peripheral servers.

C. **Log/Report Printers:** The log/report printers shall be Hewlett-Packard, or equal. A TCP/IP address shall be assigned to each printer.

1. 600 dots per inch

2. 12 pages per minute output
3. 35,000 pages per month duty cycle
4. 48-MB SIMM memory.
5. 350-sheet paper capacity
6. Internal 35 MHz processor with font management software
7. 45 scalable typefaces

D. **Ink Jet Printers:** Full color, non-impact, ink-jet type printer(s) shall be furnished to produce quality multi-colored reproductions of the graphic operator interface CRT displays. The printer shall produce an image on standard 8-1/2 x 11 inch single-sheet paper in less than 120 seconds with a graphic resolution of 600 dpi black and 300 dots per inch color. Printer shall utilize four (black, cyan, magenta, and yellow) disposable print cartridges and be capable of accurately reproducing all color shades which can be generated for the DCS graphic displays. Printer shall also accept clear polyester film for creating transparencies of CRT displays, reports and logs. Printers shall have Adobe PostScript Level 2. Printers shall have **160 MB** built-in RAM, 250-sheet paper feeder, and shall be Hewlett-Packard, or equal. Printers shall be connected directly to the DCS highway using an internal printer server card.

E. **RESERVED.**

2.12 PERIPHERAL CABLING

A. The DESIGN-BUILDER shall provide and install all peripheral device cables. The DESIGN-BUILDER shall review the Contract Documents to determine exact length requirements.

2.13 EQUIPMENT ENCLOSURES AND CONSOLES

A. **General:** The DCS equipment furnished under this Contract shall be housed in enclosures designed to provide physical and environmental protection for the interior modules, busses and terminations. All PCM enclosures shall be provided with dual feed, fully redundant power modules utilizing power auctioning to provide intermediate power to all enclosure components. Input power source shall be 120 Vac 60 Hz and 125 or 24 V dc. Enclosures shall contain racks which allow easy removal of all modules, i.e., processors, I/O boards, power supplies, etc. without removal of wiring or power. All modules shall be restrained to prevent accidental disconnection. Each enclosure shall be designed to pass through a 36 x 90 inch doorway opening. All equipment enclosures shall be UL-listed or certified by a qualified third party as meeting UL requirements.

B. **Field Enclosures:** Field enclosures shall provide moisture and contaminant protection and meet the electrical classification specified. Enclosures shall as a minimum provide NEMA 1 protection. Internal air circulation fans to aid in convection cooling or other means of temperature conditioning shall be provided as needed. Power and signal wiring shall enter the enclosures from its top or bottom section and terminate at termination assemblies residing in the bottom or side sections of the enclosure. Terminal connections shall support a single 12 AWG or two 14 AWG wires. A terminal shall be provided for each conductor of external circuits plus one ground for each internally powered analog signal shield. Each analog loop shall be individually fused with all fuses or circuit breakers clearly labeled and located for each maintenance if individual isolation is not provided at the board level.

C. **Area Control Room Consoles:** Area control room consoles shall be ergonomically designed to optimize the utilization of the WSs and printers, provide proper operational

and maintenance access, and conceal interconnecting cables and wires. Consoles shall consist of free-standing high-quality modular office systems designed for computer use and support. The DESIGN-BUILDER shall coordinate with the Owner to determine colors, materials, arrangement, and lighting. Each console shall provide covered storage space for reference materials, drawer unit(s) for office supplies, and at least 3 linear feet of free desk area per workstation. Power poles for data and power cables shall be provided. Area control room consoles shall be provided with one design-coordinated ergonomic chair for each WS and shall be manufactured by Knoll, Steelcase, Herman Miller, or equal.

2.14 NITROGEN GAS PURGE SYSTEMS FOR PCMs

A. Where required, the DESIGN-BUILDER shall furnish a nitrogen gas purge system which continuously purges PCM enclosures with nitrogen gas at the rate of one (1) complete volume change per day.

1. The nitrogen gas system shall consist of nitrogen cylinders piped to a common manifold with individual branch circuits extending to each enclosure to be purged.
2. The manifold system shall include;
3. A discharge pressure regulator on the manifold
4. An isolation valve for each cylinder
5. A check valve for each cylinder
6. An isolation valve on each branch circuit
7. A check valve on each circuit
8. All ancillary piping, fittings, and accessories

B. Suitable couplings and flexible pipe sections shall be provided on each branch to permit the quick removal and installation of cylinders on a routine basis.

1. All valves, fittings, and accessories shall be 316 stainless steel.
2. All components, including but not limited to, piping, enclosures, liquid nitrogen cylinders, gauges, fittings and other accessories shall be purchased. Temporary rental or leasing arrangements will be acceptable.

C. A minimum of 2 liquid nitrogen cylinders, each containing the equivalent of 3600 cubic feet of nitrogen gas at atmospheric pressure will be provided for each system.

D. Each cylinder shall deliver gas reliably and continuously without pressure fall-off. The pressure building regulator shall maintain minimum operating pressure while the economizer regulator shall reduce excess pressure during non-use periods.

E. Each liquid nitrogen storage cylinder shall have the following features;

1. Allow direct gas flow without auxiliary equipment.
2. Sustain discharge at required pressures.
3. Be capable of providing gas at a maximum continuous rate of 25 cubic feet per hour
4. Be capable of providing gas at a maximum intermittent rate of 100 cubic feet per hour

5. Both of the flow rates noted in preceding items 3 and 4 shall be delivered with only regulator and piping attachments required. An external heat exchanger shall not be utilized.
6. Have a built-in shock absorbing system to resist rough handling during transport.
7. Have self-contained controls and piping which is protected by a stainless steel ring which is welded to the top of the cylinder.
8. All valve handles shall have a low thermal conductivity to permit comfortable operation without the need for gloves.
9. A strong internal support system to provide added stability and added protection under all working conditions.
10. Fully insulated cylinder walls to reduce evaporative losses through the pressure relief valve.
11. A built-in automatic pressure building system to allow immediate operation after filling or pressure transfer.
12. A built-in evaporizer to provide direct gas flow without auxiliary equipment. A built-in economizer circuit shall be provided to reduce evaporative pressure build up during idle time and provide virtual no-loss operation. Evaporative losses during periods of non-use (zero-gas withdrawal) shall not exceed 2.5 percent of the stored volume per day
13. Designed for unattended service or operation subsequent to initial set up without the need to make repetitive pressure adjustments.
14. The following devices shall be provided for each cylinder in conformance with the technical requirements which regulate the quality of such devices as defined in the contract documents;
    a. gas pressure gauges
    b. Container bursting disc
    c. safety relief valve
    d. manual gas vent valve
    e. economizer regulator
    f. pressure building regulator
    g. manual pressure building valve
    h. liquid level gauge
    i. casting bursting disc
    j. manual liquid fill and withdrawal valve
    k. pressure building coil
    l. vaporizer
    m. Gas withdrawal check valve.

F. Each cylinder safety relief valve shall be set at 235 psig with a normal container gas operating pressure of 125 psig. A single pressure regulator, adjustable between 0 and 3.0

psig shall be provided on the manifold gas line to maintain a desired positive pressure in each enclosure being purged.

G. Unless otherwise specified or shown, all piping, fittings, valves, and other accessories shall be ¼- inch diameter.

H. All cylinders shall be secured by retainers to prevent tipping over.

I. All PCMs which are purged shall be provided with sensors which detect and transmit to the DCS the following conditions:

a. A low pressure condition internal to the enclosure.

b. A high temperature condition internal to the enclosure.

c. An enclosure-door-open condition.

J. The complete nitrogen purge system shall be checked-out and in operation prior to the installation of related PCMs. All costs associated with nitrogen deliveries and refills prior to system acceptance shall be the responsibility of the DESIGN-BUILDER.

K. All cylinders, valves, piping, enclosures, and other equipment comprising the nitrogen gas purge system shall become the property of the Owner upon system acceptance.

2.15 OPERATING SYSTEM SOFTWARE

A. **Operating System Software (OSS)**: The OSS shall be a multiprogramming operating system in that it shall support multiple processes by sharing computer resources with processes intercommunicating with various forms of resource sharing occurring via a network. The OSS shall be a multitasking (i.e., supports multiple processes per user). All processes shall be defined as units of activity characterized by a single sequential thread of execution, a current state, and an associated set of resources. The OSS shall be a Microsoft Windows, or equal. The OSS shall provide the following functionality:

1. Multi-tasking to provide task suspension and priority scheduling of task execution.

2. Hardware interrupt priority handling.

3. Network communications to accommodate program downloading from the host server and to respond with data transfers as required by the host or interactive shared display system.

4. Support for multiple processors.

5. TCP/IP shall be implemented on this project. All OSS's shall be provided with SMP. OSS's which feature SMP and TCP/IP but which do not implement it are not acceptable.

2.16 SYSTEM CONFIGURATOR

A. **General:** The following software components shall be furnished to structure and customize process operations and information management tasks. The ability to modify the structure at a later date shall also be provided.

1. **Display Building, Configuring and Editing Tools:** Software tools shall be provided for developing, editing, using and managing displays. Sophisticated display structures shall be configured as defined by the DESIGN-BUILDER subsequent to the finalization of user meetings and graphic submittals. Displays shall be constructed from a combination of pre-defined graphic objects that shall be developed, maintained, and manipulated. The Display Builder shall contain libraries of grouped objects and separate libraries of user- and system suppliers-

defined marker tables. Addition to the libraries shall be provided by incorporating user-defined objects named and created with the Display Builder. Addition to the marker tables shall be provided by using the Marker Editor in the Graphics Utilities.

2. **Display Builder:** The Display Builder shall use pull-down menus and a high resolution pointing/input device, such as a mouse or trackball, for function selection. It shall also create overlays as unique files. It shall be possible to configure any number of overlays to exist on the screen at any one time. Overlays or "windows" shall contain any information that must be invoked quickly from a "base" display (typically for gaining more detail). The builder shall be a general purpose, object-oriented editor for the construction and editing of detailed, interactive displays. It shall produce an object-oriented data base that is used during the building process. The software shall enable the operator to build displays representing any type of application.

   a. The following types of objects shall be furnished as a minimum:

      1) Geometric Shapes -- Lines, rectangles, polygons, arcs, and ellipses.

      2) Text -- Alphanumeric characters in a variety of fonts and sizes.

      3) Markers -- Small, single-color shapes such as pumps, valves, and icons that are used repeatedly.

      4) Groups -- Object(s) composed of other objects.

      5) Library Group -- Standard and user-defined objects for inclusion in user-built displays.

   b. There shall be no inherent limit on the complexity of objects or the number of objects contained in another object. Display objects shall be connected to control algorithm parameters and system variables. Configured displays shall remain editable by the Display Builder. Display objects shall have the following editing features as a minimum:

      1) Move -- Change the location of an object within a display.

      2) Stretch/Shrink -- Alter the dimensions of an object.

      3) Cut/Copy/Paste -- Delete, duplicate, and add objects.

   c. Drawing functions shall be organized as a set of tools and resources, selectable from the menu bar, that are used to construct and edit objects. Resources shall be used to aid in the construction. These major functions shall include as a minimum:

      1) Filing

      2) Library functions

      3) Drawing

      4) Editing

      5) Resources

      6) Grid

3. **Display Configurator:** A Display Configurator shall be furnished to convert static displays into dynamic displays that interact with the process, and provide a logical hierarchy of control capability. Connection of display objects, trend objects, or

X/Y plot objects to shared system variables to reflect the current value of the variable, or to connect to control variables to allow the operator to view and change the value of the variable shall be provided.

a. Selectability configuration of a given display object shall be provided to perform one or more of the following functions when the operator picks that display object:
    1) Run/execute a program
    2) Call up a display or overlay
    3) Close the current display or overlay
    4) Write text to a file
    5) Set a relative pick
    6) Ramp
    7) Momentary contact (Hold-down Pulse or Timed-Pulse)
    8) Trends, X/Y profile plots

4. **User Interface:** Associated variables (process or shared) with display objects shall use both graphical and hierarchical methods to move about and within the display object data base. Pull-down menus accessible from the display field shall select objects in the display hierarchy and specify connection attributes.

    a. **Display Object Data Base:** The Display Object data base shall be composed of all the display objects that are all part of the hierarchy of object groups. The root group shall contain all display object groups. At each level in the hierarchy, the associated display menu shall indicate the position of the currently selected object in the hierarchy as well as of the connectable attributes of that object.

    b. **System Data Base**: The System data base shall be any system variable or value in the system that is accessible through the Object Manager. This shall include all shared program variables and all control variables. The system data base shall be accessed by typing the qualified path name of the system variable to be read or written in the appropriate connection dialogue box.

5. **Display File Manipulation:** The Display Configurator shall accept Display Builder files to configure as well as installed files to re-configure. Direct access to Display Builder software for necessary object changes shall be furnished. Once a display is configured, it shall be installed automatically for use by Display Manager in an interactive mode.

6. **Connection Types:** Any connection between an external variable and a display attribute shall be active or passive, and continuous or discrete. Active connections shall alter process or system variables in response to operator manipulation of the display. Passive connections shall alter attributes of display objects in response to changes in process or system variables. Also, attributes shall be active and passive and the system shall be able to configure both an active and a passive connection for them. The active connection shall determine the behavior of the object (position, shape, text contents, etc.) as long as the object is selected for user manipulation. The passive connection shall determine the behavior at all other times. Continuous connections shall vary continuously over a given range, such as flow. Discrete connections shall exhibit a finite number of states, such as pump status or steps in a sequence.

7. **Connection Configuration:** Selecting an object and the desired object attribute for connection shall present an appropriate configuration dialogue box. The dialogue box shall allow the operator to enter a connectable variable and related configuration information (e.g., state table, type of pulse, change delta). If the

object selectability attribute is to be configured, the function menu shall become selectable. Selecting the desired function accesses the appropriate dialogue box for configuration. Selecting a trend or plot shall provide access to configuration dialogue boxes specific to trends or plots. Changes to or deletion of configured connections shall be by the connect menu.

8. **Display Conventions Configurator:** The configuration shall be a menu driven subsystem that allows the operator to build and edit named conventions used to connect display object attributes, such as color and text contents, to individual bits in control strategy: algorithm parameters and global variables. Bit assignments for algorithm parameters, connections to any data type: long integer, floating point, byte, and character shall be possible. Objects shall be bitmapped: rectangle, polygon, arc, text, and marker. Their attributes include visibility, color, fill color, line style, marker number, text contents, and background color. Display Builder and Display Configurator shall be used in conjunction with Display Conventions Configurator. Conventions shall be stored in a file that is read by the Display Configurator.

9. **Graphics Status Attributes Configurator:** This software shall be furnished to edit a configuration file used by the Display Manager to show out-of-service (OOS) and bad input/out (BADIO) status of control algorithms in Detail displays, faceplates, and user displays. Display objects that are connected to a point that reports one of these states shall change the graphic attributes of the object. Display actions for BADIO and OOS shall be separately configurable. The configuration file shall be global and shall govern the graphic behavior of all workstations. The configurator shall provide a brief description of the command options, show the selected configuration, and prompt for any changes. Also, a file with default values shall be supplied for the system. Display objects to display the connection status are: Rectangle, Normal Text, Overstrike Text, Polygon, Circle, Arc, Line, Polyline, Mark. As a minimum, their attributes shall include visibility, color, fill color, line style, marker number, foreground and background color.

10. **Graphics Utilities:** A collection of general purpose graphics editors and utility files for the construction of new fonts and markers, or for editing system supplied fonts and markers shall be furnished. In addition, a color palette shall be available with both the system supplied colors and colors that are customizable.

    a. The editors shall be used to modify both the standard system graphic utility files which store system markers, fonts and colors, and user graphic utility files for user markers. These files shall be referenced by all displays upon display call up.

    b. The fonts, markers, and colors shall be accessible in the Display Builder and Display Configurator software for use in building and configuring displays.

    c. Font Editor Software shall allow the operator to edit a font set or create a variety of fonts for use on displays. When accessed within the Display Builder, the selected character font set shall be made available in one of four sizes: single-width, single-height; single-width, double-height; double width, single-height; double-width, double-height.

    d. Marker Editor Software shall allow the operator to create graphics symbols that are used repeatedly. Symbols shall appear as industry-standard shapes, and shall be included in a marker table.

e. The Color Palette Editor shall allow the operator to edit colors in the system palette file or create palette work files. The user shall be able to change the foreground and background colors available from the color palette to create more than 16 million colors. At least 233 colors shall be available for use in process diagrams. The first sixteen background colors are standard colors related to system displays. Blink colors shall also be settable.

11. **Workstation/Mode Configuration:** The User's view of the system and the process to which it is connected shall be provided. A specific mode shall be associated with a user, a group of users, or fixed for a given workstation.

a. This shall be the first level of security for accessing and manipulating system information. The second level of security shall be provided by restricting the selection of individual fields within displays. Different modes shall have different groups of selectable fields for the utmost security. Workstation configuration shall be enabled by the Password Mode Configurator. It shall allow the flexibility to set up security schemes to match plant operation setup.

b. The configurator shall be a collection of mode editing functions and tools that maintain a set of configuration data files that allow the following functions:

1) Provide access security for the different operation modes of the system.

2) Allow an authorized user to modify mode menus (menu bar entries), and to associate specific displays with the invocation of any given mode.

3) The configurator shall be able to run in any workstation as a transient application task, and shall operate primarily with simple menu selections and dialogue box prompts. An alphanumeric keyboard and a high resolution input device, such as a mouse or trackball, shall be required for configurator operation. Any input device can be used to access menus subsequently built.

c. There shall be six default modes, in order of increasing capabilities and access:

1) View Only

2) Senior Operator

3) Operator

4) I & C

5) Programmer

6) Administration

d. The content of all modes and menu bars shall be able to be configured to suit the user. Additional modes shall be assigned by using the configurator.

2.17 WORKSTATION (WS) APPLICATIONS

A. **General:** Window systems shall manage the user-OSS interface that deals with multiple processes and the display of those processes from virtual displays via space multiplexed physical displays. Each WS shall employ a base window system designed for use in a networked, bitmapped workstation mode. The operations for placing information on the screen include graphic oriented and character oriented commands for monochrome and color displays. The windowed implementation shall divide an implementation into a client and a server with a specialized interface between them. The protocol between the client and server shall be of a sufficiently high level (and general) that the client and

server can be implemented on distinct machines interconnected by the network although the usual workstation configuration is to implement the two parts on a single machine. The user interface shall provide the fundamental facilities required to support a desktop management implementation which explicitly addresses space multiplexing for representing virtual terminals-across multiple physical screens that operate with a single physical keyboard and mouse, each with its own application process.

B. The display software furnished shall enable any Operator WS to interact with any and all of the real-time plant, field and process data that is provided in the system. Areas of operational access or "modes" for the workstation shall be changeable on-line and shall be pre-configured by using a Password Mode Configurator.

C. All screen selections shall be based on intuitive "picking" of display objects and menus on the screen. A common menu bar structure with pull-down menus shall be presented at the top of all displays to enable fast access amongst available workstation functions. Multiple windows with icons shall also be available. Content of the menus shall form the display hierarchy.

D. The Real-Time Display Software shall support either single-screen or dual-screen operation. Single-screen operation shall allow workstations to operate independently of one another; e.g., duplicate workstations can have duplicate or independent responsibilities. As a minimum, dual-screen real-time software shall provide the following:

1. Ability to direct input devices such as a mouse, trackball, or keyboard, to multiple screens.
2. Ability to enable/disable keyboard and cursor device on-line.
3. Ability to redirect displays from one screen to another and to support up to four process diagram windows on each screen.
4. Ability to call up multiple displays simultaneously with a single request.
5. All process diagrams shall be available for dual-screen use.

E. Windows and menus shall be used by the Graphical User Interface to provide an intuitive windows mode. Windowing shall take advantage of the multi-tasking operating system capability. It shall allow to begin a task in one window while continuing work in another. It shall also allow a single CRT interface within the system using Remote Desktop or rDesktop for interfaces with the DIN and DCS highway (information networks). As a minimum, the following applications that concurrently appear in its own window shall be:

1. Network Manager
2. Display Manager
3. Data Acquisition and Control Configurator
4. Report Configurator
5. Historian Configurator
6. Operator Message Interface
7. Spreadsheet
8. Command prompt mode
9. Electronic Documentation Print Routine
10. Loadable Documentation

11. Help Functions

12. Window from DCS highway and DIN

F. **SCADA Server Application:** The DESIGN-BUILDER shall provide SCADA server application(s) loaded on a WS(s) to function as a gateway(s) between third party applications and systems. The SCADA server application shall serve as a replacement for WESGATE server applications under the WDPF II platform.

2.18 NETWORK MANAGEMENT SOFTWARE (NMS)

A. **General:** Each network connected device shall be provided with NMS which provides an operator with a means to:

1. Define users, groups, and their access privileges. The NMS shall be able to define the domains to which the users and groups belong. Domains shall define a set of servers and resources to which users and groups have automatic and transparent access.

2. Analyze the server performance and resource statistics to determine potential bottlenecks.

3. Monitor the network traffic, to identify problems after they occur, and more importantly, to spot potential trouble before it happens.

B. **Intelligent Facilities**: The intelligent facility operators' information and object domain shall be managed by NMS. NMS shall regulate all aspects of heterogeneity, resource management, performance monitoring and tuning, and other administrative tasks. The end result shall consist of the organization and management of facility and Department objects not files and directories. Facility and Department objects may physically consist of files and directories, but the emphasis shall be on managing the object as a whole by the NMS. The NMS shall support both Version 1 and Version 2 Simple Network Management Protocol (SNMP).

C. **Information and Object Domains**: The NMS shall provide users access to resources in an efficient and easy-to-use way. An intelligent facility worker's information and object domain will be managed by the NMS which shall be responsible for of all aspects of heterogeneity, resource management, performance monitoring and tuning, and other administrative tasks. Note that this is an organization and management of facility objects not files and directories. Facility objects may physically consist of files and directories, but the emphasis is on managing the object as a whole by the NMS. The NMS shall employ a global naming service in that the NMS shall support, on all WS and external systems and network components with support for SNMP, an intelligent facility mode which concentrates on the administration and management of intelligent facility objects, such as the following;

1. Processes

2. Process Area

3. Facility Plans and Fire Detection

4. Maintenance Management

5. Laboratory Information Management

6. Operation and Maintenance Data

7. Plant Security and Communications

8. Training Network

9. Energy Management
10. Peripherals and devices
11. Policies and procedures
12. Plant/Department Staff

D. **Global Naming Service:** The NMS shall provide users access to resources in an efficient and easy-to-use way. The NMS shall employ a global naming service in that everything on the network shall be assigned an item name, a group name, and an organization name. Using this approach, if a user wishes to get run-time related maintenance management data from the MBC locale, the item is called "run time"; the group is called "maintenance management" and the organization "MBC". The name "RUN TIME @ MAINTENANCE MANAGEMENT@ MBC would precisely define the location of the data in a straightforward manner.

E. **Standard Protocol**: The NMS shall conform to a standardized protocol that makes it possible to maintain complex internet works and reconfigure resources as patterns change. The NMS shall be designed for the purpose of monitoring network performance, detecting and troubleshooting network faults, and configuring or reconfiguring network resources. The standard protocol shall include SNMP.

F. **NMS Organization**: The NMS shall be based on 3 major components; the NMS protocol, the management information base (MIB), and the structure of management information (SMI). The NMS shall be an application-layer protocol stack that defines a common method of communications among network devices. The MIB shall define a common set of information variables and statistics that must be kept. In addition, the MIB shall define an OSI-compliant registration hierarchy that groups logically related information into tables. For example, information relating to the error rates and addresses of communication interfaces would be placed in the interface table. The NMS shall also consist of agent software, which resides at the location of each resource being managed. The other element of the NMS is the network management station, which contains the master database of resources being managed.

G. **NMS Components**: NMS shall consist of a bundle of software that resides and runs somewhere on a network device, usually imbedded in a Fast Ethernet network interface card. It communicates closely with the network chipset, monitoring the activity of the chips and the network making any necessary modifications. The NMS shall consist of the following object components;

1. Management shall;
    a. Initialize MAC (medium access control layer) for data transmission
    b. Detect and resolve duplicate address conditions
2. Connection Management (CMT) shall manage the connection of the physical network. CMT shall consist of;
    a. Entity Coordination Management (ECM) which shall;
        1) Propagate trace to detect ring fault domains

    b. Physical Connection Management (PCM)which shall;
        1) Initialize port-to-port connections.
        2) Monitor bit error rates on links.
        3) Enforces connection policies.

4) Controls PHY (physical layer) and PMD (physical medium dependent layer).

c. Configuration Element Management (CEM) which shall;

1) Clear ring of frame fragments.

2) Reconfigure station resources.

3) Enforces configuration rules.

4) Controls the CCE.

3. NMS Agent which shall receive, parse, and respond to frame-based requests from the network.

4. Neighbor Notification Transmitter (NNT) which shall monitor the identity of the MAC's upstream and downstream neighbors.

5. Status Report Frame (SRF) which shall implement a protocol used to notify the network of changes in station status.

6. Management Information Base (MIB) which shall provide access to NMS variables in a generic manner. The following types of data shall be in the MIB;

a. SMT- Items about SMT in general

b. MAC- Items specific to a MAC

c. Pathclass- Items relating to paths in general

d. Path- Items relating to a specific nonlocal (primary or secondary) path.

e. Port- Items relating to a specific port

f. Attachment-Items relating to a specific attachment.

H. **Network Security**: The NMS shall defines the access rights of the users on the networks and determines what resources a user has access to and what operations that user may perform on those resources. Security and authorization shall be based on the concepts of users and passwords. The network administrator shall be able to define every new user for the system, gives the user an account, and assigns that user to the rights to various network objects. To gain access to the system, users must log on to the system, specifying both their user names and their passwords. Passwords shall be unique and shall be specified to be of minimum acceptable length. All passwords shall be encrypted and are sent across the network only in encrypted form. The NMS shall facilitate the periodic changing of passwords on a routine basis.

I. **Network Authorization:** Files, directories and devices shall be protected by a number of access rights. The user shall be given privileges (such as read, write, update, delete, modify attributes, perform directory search, execute, create, and supervisory) at the file or directory level. Files themselves shall be further protected by attributes such as read-only, which shall prevent the file from being modified. The NMS shall feature a security database which shall be responsible for assigning and tracking the privileges of all objects on the network. All objects, such as users and files must be registered in the security database. This database then determines who is allowed access to what object.

J. **NMS Displays**: NMS shall run on any workstation in any mode with the capability of NMS menus and displays appearing on any number of workstations simultaneously. There shall be multiple copies of this software concurrently resident within the system. Operator actions shall be performed through a number of menus and displays that are initially accessed by pull-down menus. NMS shall determine which conditions exist and shall put up the appropriate NMS health display. The NMS shall display shall show all

stations/ connections on the network. Selection of the NMS display feature shall give the stations and their logical names showing the all domain and station status. Pointing/input devices used for displays shall be mouse, trackball, or touch screen. Using NMS, the operator shall be able to have access to the following features;

1. Viewing hierarchical system and network displays indicating the health of system equipment and network communications. Access to information from the system network down to the intelligent sensor level shall be available both in a graphical and tabular format.
2. Network statistics for analyzing network performance.
3. Display system monitor domain information and complete information about stations and peripherals within the domain.
4. Allow an operator to perform equipment change actions, such as rebooting a station or putting a peripheral off-line.
5. Running On-Line and Off-Line diagnostics.

K. Network Configuration: NMS shall utilize a system configurator which consists of a series of editors used to create a network by linking all network hardware and software modules. Each editor shall list all available hardware and software resources. The NWS shall be used to define all logical and physical connections associated with the network. This network configuration function shall be accomplished by selecting items from logically organized pull down menus, selecting appropriate software modules, and assigning network identification tags and descriptors. The NWS shall have self-checking utilities that verify the existence of all necessary logical connections. If the network has logical gaps, the NMS shall identify the concern and display the missing linkages or modules.

2.19 DISPLAY MANAGER

A. The Display Manager window shall present the initial control systems display and shall always be present on the screen (as window or icon) and shall be used to view process displays. It shall also provide consistent access to other application windows via the top menu bar and pull-down menus. Workstations shall be directly connected to applications running on other platforms to allow single operator interface to multiple systems and multi-media capability.

The contents of the selected application shall be displayed in a base window on the background screen area (workspace). Control of the workspace shall be handled by using the mouse/trackball buttons, touch screen (to emulate left button), and function keys to perform the following actions as a minimum:

1. Access function menus, window, and icons - stack a window in front or back of another window.
2. Make selections from menus.
3. Manipulate the size and location of windows - toggle between two window sizes, and change window dimensions.
4. Iconize a window - change the window to an icon representing it in compressed form or open an icon to its full size window.

B. The types of menus as a minimum shall be:

1. A window menu for performing functions related to the window, such as re-sizing, moving, re-stacking, opening/closing.

2. A Workspace menu for accessing a function or sub-menu of functions, such as, programs, utilities, properties.

3. Scroll bar menu, for scrolling specified text in the application pane to new locations within the pane or back to the previous position.

4. Pop-up windows for filling in information or making choices. These menus shall be available under menu buttons in the control area or as pop-up menus at the pointer location. Menus shall be accessible on a temporary basis, available until dismissed, or push pinned to the workspace for ready access.

2.20 DATABASE CONFIGURATOR

A. **General:** Each WS shall provide a comprehensive, distributed interactive database system for creating, storing, editing and monitoring all process inputs, outputs, manually entered data, and internally calculated values. Process data point creation shall utilize conversational fill-in-the-blanks techniques for ease of use by the process engineer. The Database Configurator shall provide a file-oriented structure for the purposes of data acquisition, data conversion, digital filtering, scaling, and alarm checking. All of the parameters and features noted shall be individually selectable and modifiable in an on-line fashion at the CRT console. As a minimum, the configuration software shall provide/perform the following functions:

1. Each input or calculated value shall have a unique tag and descriptor. The configurator shall accept a tag of up to 16 characters and a descriptor length of up to 30 characters. All data shall be tag accessible and not require an imbedded hardware address.

2. Process inputs shall be capable of being processed for alarm detection and control processing at a user adjustable rate between 0.1 and 1.0 seconds.

3. All process outputs shall be capable of being updated at an adjustable rate between 1 and 3600 seconds. Sequence of events (SOE) points shall be adjustable to be updated at least once per 0.1 second.

4. Filter, scale and linearize raw input signals into engineering units based on a scale of 0 to 65,000 counts. Point resolution shall be at least 13 bits.

5. Check input signals for instrument limit conditions.

6. Assign alarm limits for high, low, and rate-of-change limits.

7. Assign alarm priority levels. At least 4 levels of alarms shall be definable.

8. Each data point shall have the capability of assuming various grades of quality status. The state shall provide the operator with and indication of the quality of the hardware and software. As a minimum, the following states shall be provided:

- GOOD: This state shall indicate hardware and software are functioning properly.
- ENTERED VALUE: In this state, the data point shall not be processed. Data values may be inserted by the operator.
- POOR: This state shall indicate a software malfunction. The data point shall

- BAD: This state shall indicate hardware malfunctions such a multiplexer failure, transmitter failure, open thermocouple detection, etc. In this state, the last reasonable data value shall be maintained in memory. When the hardware malfunction clears, the data point shall be automatically returned.

B. **Data Validation:** The data point state shall be combined with the process alarm conditions to indicate data point status in a concise manner. Hardware and software malfunction shall precede process alarms. If the data point state is BAD, its status shall also be BAD, irrespective of previous process alarm condition. However, if the data point is being monitored with a high alarm present, its status shall be HIGH.

2.21 DATA ACQUISITION AND CONTROL CONFIGURATOR

A. **General:** The Data Acquisition and Control Configurator shall enable the development and modification of control strategies using a menu driven fill-in-the-blanks conversational technique. The DESIGN-BUILDER shall furnish a standard library of data acquisition and control algorithms to monitor process variables, detect errors between desired setpoints and measured variables, and issue corrective commands to manipulated variables such as final control elements. Control algorithms shall also be provided to perform sequential and SAMA diagram control. As a minimum, the library of control algorithm algorithms shall provide the following functions or algorithms that provide equivalent functionality:

1. Process Inputs and Outputs: Analog Input, Contact Input, Analog Output, Contact Output, Boolean Alarm, Pattern Alarm, Event, Flow Calc...
2. Process Control: PID with Options, Ratio, Bias, Differential Gap, Pulse Duration, Self-Tuning Adaptive, High, Low, Switch Position, Universal Ramp, Timer, Status.
3. Calculations: Impulse, Lead-Lag, Dead-Time, Add/Subtract, Multiply/Divide, Square Root, k Exponentiation, Characterizer, Pulse Counter, Accumulator, High/Low Clamp, Rate of Change Clamp, Packed Boolean.
4. Logic: AND, OR, NAND, NOR, XOR, NXOR, Logic Switch, Compare, Bi-Directional Delay, On-Off with Feedback, NO Contact, NC Contact, Energized Coil, Latch Coil, Unlatch Coil, Retentive Timer On-Delay, Retentive Timer Reset, Up-Counter, Down-Counter, Counter Reset, Compare, Program Flow Control, Immediate Input, Immediate Output.
5. Sequential Control: High Level Batch Language (HLBL).

B. Configuring a data acquisition and control scheme shall be performed by linking, from a pre-defined standard list of control algorithms. Operation shall be in an off-line and on-line fashion and shall in no way disrupt the normal operation of independent loops. Pull down menus shall be employed so as to maintain a consistent human interaction with the system.

C. A backup image of the data acquisition and control configuration shall be available at each WS, or in a central server with RDBMS maintenance tools, for reloading of the controller when required. The storage medium shall be an "on-line" bulk storage device - tape or cartridges are not acceptable.

D. Automated system security measures shall preclude the possibility of dissimilar database structures, data acquisition strategies, or control strategies from being resident in the set of fault tolerant processors associated with each PCM. All database structures, data acquisition strategies, and control strategies shall be either downloaded to both PCM

processors simultaneously or sent to the "backup" processor which automatically reflects or mirrors the image to the "on-line" processor.

E. The control configurator shall be self-documenting. The present operating control schemes shall be accessible from at least two WS in the central control room, and one additional WS. All additions or modifications shall be automatically recorded and shall require no additional operator action. Remote control configuration shall be available from the COMC using rDesktop.

F. **Data Acquisition Software Algorithms**: The following data acquisition algorithms are being defined to indicate the level of functionality and inter-algorithm interaction associated with fundamental data acquisition functions required for this project. This listing is not all inclusive of project requirements in that additional algorithms may be required to configure a complete and operable system. In all cases, each PCM shall scan analog and discrete inputs at a uniform rate. Existing data samples and status information stored in the PCM current data base memory shall be updated by data and status entries obtained during each new data channel scan.

1. **Analog Processing Algorithms**: All analog inputs shall be sampled at a fixed rate and normalized to eliminate zero drift errors and gain errors. Normalization shall be provided for by applying at least two calibration signals (zero and a positive calibrated reference signal) to a dedicated analog-to-digital converter assembly and then applying a normalization equation. Signal conditioning shall be applied where applicable including digital filtering, linearization, etc. Digital filtering requirements will be determined by the DESIGN-BUILDER during the construction period. All transducer signals which bear a nonlinear relationship to the associated measured variable shall be linearized. Signal linearization may be accomplished using table look-up linear interpolation techniques, straight line segment conversion multi-techniques, or by using conversion equations. All analog inputs shall be validated prior to signal conversion and subsequent entry into the current database.

   a. Fifth-Order-Polynomial

      $Y = K_1 + K_2 X + K_3 X^2 + K_4X^3 + K_5X^4$

   b. Power

      $Y = K_1 + K^2 (X)^{K}3$

   c. Exponential

      $Y = K_1 + K_2e^{K}3^{X}$

   d. Logarithmic

      $Y = K_1 + K_2 (\ln X)$

Where:

Y = Linearized variable

X = Measured variable

e = Base of the natural system of logarithms (e = 2.7182818...)

ln = Natural logarithm

K = Constant whose value and polarity shall be selectable at the WS for each individual measurement channel.

e. Scaling: All 4-20 MA analog inputs shall be scaled to a common span. Scaling operations shall not reduce the accuracy of the data. Analog data shall be converted to engineering units by means of the following algorithm:

$Y = (H-L)^{(X)} + L\ (Z)$

Where:

Y = value in engineering units

H = high value of span, expressed in engineering units

L = low value of span, expressed in engineering units

X = digital value of normalized and linearized data sample

Z = full scale digital data value

f. Filtering

A digital filtering algorithm of the exponential smoothing type shall be provided to smooth time-varying analog input data in accordance wit the equation given below. The filter time "constant" shall be a function of the sampling period and the digital filtering constant, both of which shall be user adjustable.

$V_F = V_{F-1} + K\ (V_u - V_{F-1})$

Where:

V_F = new filtered value

V_{F-1} = last filtered value

K = digital filtering constant which is given by t/T where t = sampling period and T = required time constant.

V_u = new unfiltered value

2. **Discrete Processing Algorithms**: Discrete inputs include both alarm and status inputs. At each scan interval, all discrete inputs shall be checked to determine status changes or alarm conditions. If an input changes status, the new status and time of occurrence shall be recorded in the current data base. Discrete inputs must be processed by suitable time delay/logic algorithms before alarms are noted.

3. **Manual Inputs**: Numerical engineering unit data may be entered manually in a "fill-in-the-blanks" mode at the WS. This data shall consist of additional values for the current data base (e.g., laboratory analyses result); substitution data for measured variables normally scanned, substituted output data for failed algorithms; and new or modified fixed data values (e.g., tank volumes). Variable identification symbols for non-scanned data such as laboratory analyses shall be compatible in format to those symbols used for scanned analog input variables. Replacement data entered manually to control programs shall be treated as out-of-scan analog or discrete input data. All inputs shall be subjected to validation checks to verify reasonableness of data. The system shall be configured to accept a minimum of 500 lab-oriented manual inputs which will be defined by the CONSTRUCTION MANAGER during the system construction period.

G. **Calculation Algorithms**: Calculated variables, such as summed variables, mass flow variables, tank volumes, etc., shall be derived from manually inputted constants and

analog inputs which have been normalized, conditioned, and converted into engineering units. Calculated variables shall be computed with the same frequency as their associated analog inputs and shall be stored in the current data base. Suspect data flags shall be set for calculated variables when any of the analog input variables used in their computation have exceeded any signal amplitude or rate-of-change high/low limit. Calculated variables associated with discontinuous processes shall be activated and deactivated by either a software interlock or a process input to avoid the accumulation of erroneous measurements.

1. **Square Root Extractor Algorithm**: A square root algorithm shall extract the square root of an input signal and also have the capability of applying a gain factor and bias to the output signal. A typical square root extractor equation shall be of the form:

   Output = K_1 */Y + K_2

   Where Y is the input signal, K1 and K_2 are adjustable parameters.

2. **Summer Algorithm:** A summer algorithm shall have the capability of summing or subtracting at least two input signals. The summer shall have the capability of applying a gain factor and bias to each of the inputs, and applying an additional gain factor and bias to the output or the equivalent. A typical summer equation shall be of the form:

   Output = K_1 * X + K_2 * Y + K_3

   Where X and Y are inputs, K_1, K_2, and K_3 are adjustable parameters.

   Note: * indicates multiplication

3. **Multiplier Algorithm:** A multiplier algorithm shall have the capability of computing the product of two input signals. The multiplier shall have the capability of applying a gain factor to the product and bias to the output, or the equivalent. A typical multiplier equation shall be of the form:

   Output = K_1 * X * Y + K_2

   Where X and Y are input signals, K_1 and K_2 are adjustable parameters.

4. **Divider Algorithm:** A divider algorithm shall have the capability of dividing one input signal by another input signal. The divider shall have the capability of applying a gain factor to the quotient and bias to the output signal, or the equivalent. A typical divider equation shall be of the form:

   Output = K_1 * (Y/X) + K_2

   Where X and Y are input signals

   K_1 and K_2 are adjustable parameters.

5. **Real-Time Data Averaging Algorithm**: Real-time data averaging algorithms shall be provided to calculate running averages of measured and virtual variables. The software shall not require the PCM to store all of the discrete data samples being averaged. Real-time modules shall be provided to time integrate measured and calculated variable rate data.

6. **Max/Min Algorithms**: Max/Min algorithms shall be provided which record the maximum and minimum data value generated by measured and calculated variables during a designated time interval. Two maximum/minimum identification

detection modes shall be provided. The first shall consist of monitoring discrete data values which are sequentially compared against the previously detected discrete maximum and minimum values. The second mode shall consist of averaging the three most current data values and then comparing the average against both existing and maximum and minimum averaged values. The second mode is provided to reduce the effects of random values. For both modes, previously detected maximum and minimum values shall be replaced whenever exceeded by current high and low data values, respectively.

7. **Logged Variables**: Input data shall be sorted, compressed, totalized, averaged, filed and then transferred to the WS/HISTORIAN in response to an Operators request to support functions associated with the WS/HISTORIAN.

H. **Control Algorithms:** The following control algorithms are being defined to indicate the level of functionality and inter-algorithm interaction associated with fundamental control applications associated with. This listing is not all inclusive of project requirements in that additional control algorithms may be required to configure a complete and operable system. In all cases of regulatory (modulating) control algorithm configuration, the algorithm shall be configured to track the manipulated variable or manual set point to avoid process excursions.

1. **PID Control Algorithms**: Continuous digital control (PID) shall be implemented in the PCM using a high level process control language. Control calculations for PID shall be performed after each scan of the associated controlled variable(s) and new controller set points or final control element operating values generated and issued as required. Control loop states shall be changeable from automatic to manual and vice versa via Process Control Module Logic (PCML) and under Operator control at the WSs. Manually entered control strategy data shall be validity and quality tested in the same manner as scanned input variables or calculated variables.

   a. Position and incremental outputs to final control elements shall be constrained using a PID algorithm with both high, low and rate limits.

   b. Set points shall be constrained to lie between adjustable high and low limits. In addition, if a PID algorithm is employed with an error-based derivative term, an adjustable set point ramping rate limit shall be provided to minimize process variable excursions when set point changes are introduced.

   c. Manually entered analog data values shall be buffered so that the affected parameter is ramped to its new value at a specified maximum rate.

   d. Provision shall be made to prevent windup in the PCML control algorithms.

   e. If a control strategy failure has occurred, i.e., the control strategy output exceeds second level high/low amplitude limits, an analog input failure has occurred, i.e., the input value exceeds second level high/low amplitude limits or a control strategy linkage has been broken by the Operator, all attached PID algorithms shall revert from auto control to manual.

   f. When a PID algorithm incorporating feedback, feed forward or cascaded control loops is in the "auto" state, the output of the control algorithm shall be automatically fed to the associated final control elements or to the set point of a

secondary control algorithm. In addition, all other loops within the PID algorithm shall be in the "auto" state.

g. When a PID algorithm incorporating feedback, feed forward or cascaded control loops is in the "manual" state, the control algorithm output shall be disabled and the output to the associated final control elements shall be under the manual control from the WS.

h. If one or more of the feedback control loops has failed with the outputs of all failed feedback loops being deactivated and placed under manual control one or more of the feedback loops is in a "manual" state because of a control loop failure where all failed inputs and outputs have been replaced with manually entered data; or because one more loops is in a "manual" state because the Operator has replaced valid sampled or derived data with manually entered data, then the PID algorithms incorporating feedback from the attached control loop shall revert to a manual state.

2. **Sequential Digital Control (SDC)**: Control calculations for SDC shall be performed as necessary after each scan of discrete and analog inputs associated with a particular SDC algorithm. SDC control states shall be changeable from automatic to manual and vice versa via PCML. SDC algorithms shall be linked to PID algorithms where appropriate. A SDC loop status shall be changed from automatic to manual and a change-of-status alarm generated if an associated analog input exceeds a second level high/low amplitude limit or if there are irrational combinations of associated discrete inputs. Two SDC control loop out put states shall be possible as described below.

   a. When a loop is in the "automatic" state, the output of the control algorithm is fed directly to the associated final control element(s).

   b. When a loop is in the "manual" state, the control algorithm output is disabled and the output to the associated final control element(S) is under the manual control.

3. **Lead/Lag Algorithms**: Lead/Lag algorithms shall have the capability of providing dynamic lead/lag compensation to an input signal. The lead/lag element shall represent the transfer function:

   Output = K (T1 * s + 1)

   (T2 * s + 1) *X

   Where X is the input signal.

   T1 is an adjustable lead time constant.

   T2 is an adjustable lag time constant.

   s is the LaPlacian operator.

   K is a gain factor.

4. **High/Low Selector Algorithms:** High/Low selector algorithms shall have the capability of selection of the highest or lowest of at least two input signals. A high selector shall have an output equal to the highest of the input signals. A low selector shall have an output equal to the lowest of the input signals.

5. **High/Low Override Selector Algorithm**: High/Low override selector algorithms shall have the capability of selecting one of eight control loops to manipulate a final control element. The override selector shall select either the highest or lowest of the input signals to manipulate the final control element. Additionally, the

override selector shall provide a feedback signal to non-selected controllers to prevent them from "winding-up" in the low or high direction. The operator shall be able to specify a limit for the difference between the selected and non-selected controller outputs.

6. **Auto/Manual Station Algorithm**: Auto/manual station algorithms shall have the capability of an auto/manual station which shall allow the operator to place an external bias on the input signal when in auto mode. When in manual mode, the operator shall be able to manipulate the station's output. The auto/manual station shall be self-balancing to enable bumpless transfer from manual to auto and auto to manual without any manual balancing.

7. **In-service/Out of Service Algorithm:** In-service (IS)/out-of-service (OOS) algorithms shall have the capability of masking or blocking out all or selected alarms associated with the OOS device i.e., if a wet well is declared OSS, low level alarms shall be inhibited. OOS algorithms shall be implemented using analog and digital ladder logic. If a device has been designated OSS, all control routines shall declare the equipment or a train of equipment as being unavailable for service. This will also apply to valves. Further requirements for display of Out of Service status are in Section 2.20.

   a. The OOS algorithm shall be implemented for any plant equipment monitored by the DCS and greater than 5 HP.

   b. Functions for future implementation with the MMS: The MMS EMPAC modules shall dynamically receive out-of-service status from the DCS. A tag out status for a piece of equipment entered on the MMS system shall automatically result in the assignment of an out of service status on the DCS.

2.22 ALARM CONFIGURATOR

A. Alarm Algorithms: A WS configurable alarm subsystem which manages the initialization, configuration, display, and actions of alarm messages and alarm associated keys within a workstation shall be provided. It shall provide as a minimum:

   1. List of unacknowledged alarms.

   2. Current alarm list.

   3. Alarm history list.

   4. Control of Current Alarm Display (CAD) and actions associated with process alarm messages.

B. **System Alarms:** Alarms related to the health of the network and of the stations and peripherals on the network shall be provided.

C. **Plant/Process Alarms:** Alarms related to the process control compounds and algorithms shall be provided. Information available for this type of alarm shall include the control strategy/algorithm/point name, date and time of alarm, alarm type, value at time of alarm, alarm quality, type of alarm, units, and value of alarm limit exceeded.

D. **Voice Alarm Annunciation:** The alarm subsystem shall support voice alarms using digitally recorded audio files on the WS hard disk. The voice alarm shall be of professional quality. An audio signal output on the WS shall provide a standard audio pre-amp signal to external speakers which have built-in amplifiers. The notification of

alarming at a workstation shall be suppressed by assigning an alarm the lowest priority via the Integrated Control Configurator. The sounding of a voice alarm at the workstation shall be configured based on a priority of 1 for system alarms and a priority of 2-8 for the incoming process alarms. The priority threshold for the alarm shall be user-defined. Alarm Panel and Alarm Table configurators and a user changeable file for alarm default configuration shall be provided for defining and setting up alarms.

E. **Current and Historical Alarms:** The Alarm Subsystem shall support both an Alarm History and Current Alarm Queue. The Alarm History display shall show up to 5000 occurrences (plant/process alarms and return from normal events) in chronological order. Acknowledged alarms shall be indicated by a change in color of the alarm entry, or by re-sorting or removing alarms to an Acknowledged Alarm list. Alarm entries shall clear from the CAD based on the acknowledgement and return to normal states. A field associated with each alarmable point shall be able to be preconfigured with a process diagram index, which can then be activated by selecting the point and using the cursor control device button.

F. Alarm Processing Modules: On each scan, the PCM shall test for the occurrence of such events. Upon recognition of an alarm or "return-to-normal" condition, the PCM shall retransmit the data for annunciation, display, and recording purposes. Alarm messages shall generate upon the occurrence of an alarm condition or when alarm summaries are requested. Alarm sources shall be as specified below:

1. **Alarm Processing:**

   a. All hardwired alarm inputs shall be transmitted to the associated PCM.

   b. All analog inputs and associated calculated variables configured for alarms shall be tested for high/low limit violations by the associated PCM.

   c. All analog inputs and associated calculated variables so configured shall be tested on each scan for high/low rate-of-change limit violations by the associated PCM.

   d. A discrepancy alarm shall be configurable in control logic for any final control element if an irrational combination of associated discrete inputs and outputs occurs. If a discrepancy exists between a PCM command and the device status, e.g., the PCM commands a drive to start after establishing that the device is in the "ready-to-run" condition, and the drive fails to start, then a discrepancy alarm shall be generated. Likewise, involuntary changes in device status shall be noted, e.g., pump starts when not commanded to do so or pump runs and then shuts down even though it still has a command to run. All discrepancy alarms shall be listed in the software submittal.

   e. Because many discrete final control elements have a cycle time in excess of the scan interval, each output shall have an associated delay period selected to be longer than the operating period of the final control element. Delay periods for each final control element shall be configurable in control logic. All time delays shall be listed by the DESIGN-BUILDER in the software submittal.

   f. Alarm/Event Logging: A program shall be included to log the following: Record all hardware and software generated alarms and Record "return-to-normal" for all alarms.

   g. Although many of the analog data points shown in the Contract Documents were not represented with high and low alarms, the DESIGN-BUILDER shall configure alarm points for all inputs, outputs, and calculated data points.

2. **Limit Checking**: Dual level limit checking modules shall be provided which shall identify a limit violation when every time a measured or virtual variable goes out-

of-limits and returns back into limits. The software shall determine the time at which each limit excursion occurred. An alarm limit dead band shall be provided to prevent a point which is hovering around an alarm limit for becoming an eventual nuisance. The dead band shall be expressed as a percentage of span or in engineering units and shall be adjustable from the WS. All high/low limits shall be set independently for each analog data channel. An unreasonable data alarm shall be generated whenever a signal amplitude or rate-of-change value exceeds or becomes less than a first level high/low value. Whenever a second level high/low amplitude limit value is exceeded, the operational status of associated, software-based control strategies shall be unconditionally changed from automatic to either provisional or manual control and a change of status alarm shall be generated. Whenever a signal amplitude value becomes less than a second high/low limit value a change of status alarm shall be generated but the associated control strategies shall remain in provisional or manual until placed under automatic control by the Operator. All limit check alarms shall be displayed at the WSs. The value of all high/low limits shall be established by the CONSTRUCTION MANAGER during system construction.

3. **Erroneous Alarm Suppression:** Due to the discontinuous nature of many of the sub processes associated with a treatment plant, certain discrete and analog input alarms must be processed via logic modules such as AND, OR, Exclusive OR, NOT etc. to produce conditional inputs. Typically, if a pump is directed to be in the "OFF" state, low discharge pressure alarms shall be suppressed. Additionally, if a flow meter is indicating zero flow but its associated pump is confirmed as being in the OFF condition, the non-zero value shall be set to zero to preserve system logging and trending integrity. The DESIGN-BUILDER shall submit a complete listing of data and status points which must be suppressed/manipulated in the software submittal.

4. **Rate Checking**: Rate checking modules shall be provided which shall identify a rate limit violation every time the time-rate-of-change of a measured or virtual variable exceeds or becomes less than rate limit selected at the WS. The software shall determine the time at which each rate limit excursion occurs. A rate-limit-out/rate-limit-in dead band shall be provided (expressed as a percent of the rate limit value or in engineering units) whose width may be altered at the WS.

5. **Inferential Alarming**: The PCM shall be capable of receiving down loaded process scenarios in the form of logic associations between process I/O, manual inputs and calculated invariables and use these scenarios to generate inferential alarms with an associated priority level. Process scenarios shall be developed by the CONSTRUCTION MANAGER and will consist of the implementation of AND, OR NOR, NAND GATES, signal characterization, look-up tables, signal monitors and timers. Typically, inferential alarming shall have the functionality to compare parameters associated with process equipment (amp draw, speed,), extrapolate a theoretical output from the equipment curves, and compare this calculation to measured parameter such as flow, level or pressure. If a deviation or an incongruity exists between the monitored and calculated values, an inferential or an advisory alarm will occur. A typical example of inferential alarming shall be the monitoring of the variable speed primary sludge pumps. In this instance, the DCS shall store the pumps speed versus flow parameter (either as a look-up table or as a mathematical relationship and shall also monitor pump discharge flow with a dedicated flow meter. If the pump is active and a discrepancy of "X" percent exists between the extrapolated flow and the measured slow, an inferential alarm would be generated. A total of 25 inferential alarming schemes shall be implemented by the DESIGN-

BUILDER. Subsequent to the initial development, the DESIGN-BUILDER shall incorporate this work into the software submittal and implement. Inferential alarms shall have display capabilities identical to all other DCS alarms.

G. Alarm Display and Processing: All alarm detection shall occur at the PCM level. Once detected, alarms shall be announced at the WS in the following manner:

1. Conditional text shall appear on the CRT graphic in a colored consistent with the alarms dedicated priority. Text shall describe the alarm condition and indicate present value.
2. Shapes associated with the alarm condition shall blink.
3. An alphanumeric message announcing the alarm condition shall appear in a CRT screen area exclusively reserved for alarm posting. This alarm scratch pad area shall always be present on each CRT independent of operator function. Messages shall contain time of occurrence, tag number, alarm description, current value alarm limits.
4. NOTE: Each of the preceding alarming features shall be capable of being utilized or silenced based on the priority assigned to an alarm. The alarm subsystem shall accept a minimum of 5 distinct priorities.
5. Operator acknowledgment of an alarm shall cause text/horn to change state/silence.

H. **Alarm Actions**: There shall be 4 priorities available for alarming. The alarms shall appear on the alarm list in reverse video indicating that they are "unacknowledged". Once acknowledged they shall return to normal text. The priority should be 0(white), 1(yellow), 2(magenta), and 3(red) - lowest to highest. As a minimum, the alarming package shall perform as follows:

1. Detection of a priority No. 0 alarm (informational alarm).
2. Shapes or text associated with alarm point display in a white color on the monitor.
3. Operator console annunciator announces the alarm with a Priority No. 0 intensity and pitch
4. Detection of a priority No. 1 alarm (indicative of process excursions).
5. Shapes or text associated with alarm point display in a yellow color on the monitor.
6. Operator console annunciator announces the alarm with a Priority No. 1 intensity and pitch.
7. Detection of a Priority No. 2 alarm (indicative of impending hazard to equipment or process).
8. Shapes or text associated with alarm point display in a magenta color on the CRT.
9. Operator console annunciator announces the alarm with a Priority No. 2 intensity and pitch.
10. Annunciator horn located on process floor announces the alarm with a Priority No. 2 intensity and pitch.
11. Detection of a Priority No. 3 alarm (indicative of impending hazard to personnel safety).
12. Shapes or text associated with alarm point display in a red color on the CRT.
13. Operator console annunciators announce alarm with a Priority No. 3 intensity and pitch.

14. Annunciator horns associated with the Page/Party system and located on the process floor and external to the process building which contains the alarm point announce the alarm with a Priority No. 3 intensity and pitch. The DESIGN-BUILDER shall provide the required interface cables and signals to the page/party amplifier.

2.23 REPORT CONFIGURATOR

A. **General:** The report Configurator shall consist of all resources needed to generate process, facility, department and system reports. All software algorithms shall be object oriented and linked to facilitate revisions and modifications and to minimize redundant coding of identical tasks. All software shall be structured so that an expansion in digital system hardware and/or the addition of new process inputs and outputs can be accomplished without having to reengineer report software.

B. The report configurator shall allow the operator to generate printed reports listing the status of a set of control strategies and algorithms that are in an exception condition; e.g., in alarm, in manual, not on control. The operator shall be able print or to write the report to a file, to be copied to diskette for long-term storage of report data.

1. The configurator shall be able to be accessed concurrently by several WS Processors. The configurator shall contain an easy-to-use operator interface.

2. The configurator shall let the operator select configured report files that already exist, or define new report files. Files that contain reporting selections shall include a list of available printers; control strategy and algorithm names; specifications for the control strategies/algorithms and their associated exception states and report types; alarm conditions.

3. The report configurator shall have the computational capabilities to perform the following operations;

4. Summation, subtraction.

5. Multiplication, division.

6. Integration.

7. Differentiation.

8. High/low select.

9. Average Value; hourly, shift, daily, weekly, monthly, yearly average.

10. The report configurator shall interact with resources that collects current values of specified variables from on line data storage areas, statistically manipulates data, and creates and maintains a data base of values collected. Statistical manipulation shall include linear averaging, filtered averaging, and noting of "bad" or suspect values.

C. The configurator shall enable the operator to select configured report files that already exist, or define new report files. Files that contain reporting selections shall include a list of available printers; tags and algorithm names; specifications for the tags/algorithms and their associated exception states and report types; alarm conditions.

D. The report configurator shall support the generation of 4 distinct types of report generation. Each of these types of reports shall be capable of having any or all of reporting frequencies based on hourly, shift, daily, weekly, monthly, or yearly. Process reports shall consist of a total of 75 pages with 20 variables per page; management reports shall consist of a total of 100 pages with 20 variables per page; Department

Management reports shall be as defined under 2.4 herein; and control system reports shall consist of minimum of 10 pages. Report types are as follows;

1. Facility Process Reports: Contain data derived from on-line process a measurement and lab data which has been manually inputted with an associated time and date.
2. Facility Management Reports: Contains data derived from the resources associated with the DCS highway. Reports shall include MIS, MMS, and LIMS data.
3. Department Management Reports: Contains data derived from resources associated with DIN and DCS highway.
4. Facility Control Systems Reports: Contains data relating to component availabilities (uptime); diagnostic results; network diagnostic results; listing of all alarms associated with a tag, algorithm, or hardware device; time stamps of when automatic system backup occurred; listing of all points not in scan, etc.

2.24 HISTORIAN CONFIGURATOR

A. **General:** The Historian System (HS) shall be a real-time software supported system which shall provide process management capabilities. The system shall:

1. Communicate with the Lab and Office terminals over the DCS highway, WSs, DIN devices, and all process control modules (PCM's).
2. Maintain a process information data base to support historical data storage, retrieval operations, report/log generation, trending, and event reconstruction.

B. All software shall be provided to enable historical data base generation to be accomplished by a conversational fill-in-the-blanks technique on WS display formats in which operational characteristics (i.e., name, scan class, alarm limits, etc.) are inserted into linkable prewritten software modules which perform scanning, computational, and collection functions. Once the information is transcribed into system algorithms, the data base software shall:

1. Read and interpret the information.
2. Generate report files.
3. Perform self documenting functions such as producing hard copies of listings, main and disc memories, and data sorts by analog input, analog output, contact input and contact output.

C. The software system shall incorporate a disk memory resident data base which shall store all software elements necessary to implement all data acquisition, calculation, logging and reporting functions. The system data base shall be comprised of the following elements:

1. Current data base; includes process status information.
2. Historical data base; includes non-current process status information.

D. The HS shall extract data from the communications networks at specifiable rates as defined at the WS. In addition to defining the historical database contents and the data associated collection rate, the operator at the WS shall also be able to define floating point formats, and calculation requirements. All data shall be stored in a system data base. Typical input signals to be scanned include:

1. Limit, status, or position information from open/close valves, motors and process monitoring devices such as flow, temperature and pressure switches.
2. Measured variables such as flows, pressures, etc.

3. Measurements, setpoints and outputs from PCM-resident controllers.
4. Computed values such as inferential measurements.
5. Operational commands from WSs.
6. Manually Inputted data.
7. Password Activity (sign on/sign off times, WS activities during interval between sign on and sign off by password, etc)

E. HS computational algorithms, which are configurable at the WS shall be provided to perform:

1. Average
2. Maximum and minimum
3. Time of min/max.
4. Integration.
5. Toggle.
6. Toggle reset.
7. Time reset.

F. The HS shall be provided complete with all programming that collects current values of specified variables from on line data storage areas, statistically manipulates data, and creates and maintains an historical data base of values collected. Statistical manipulation shall include linear averaging, filtered averaging, and noting of "bad" values. Statistically manipulated data shall then be stored in an historical data base.

1. The frequency of historical collection shall be selectable from 0.1 to 1 second. The type and quantity of historical data shall be selectable by addition and deletion to/from the historical data base. The HS software shall support point collection on an exception basis with adjustable dead bands, or on a time basis. The HS software shall be capable of supporting up to 10000 individual tags at varying collection intervals.
2. All required software shall also be provided to enable delta-band data storage techniques.
3. The HS shall be furnished complete with all utility and application software required to enable interaction with all subsystem specified.
4. The DESIGN-BUILDER shall provide fully paid up licenses for all software packages provided.
5. The DESIGN-BUILDER shall provide any necessary licenses, media or documents normally provided to support the operating Historian System.

G. Historian software shall be the Emerson Ovation Process Historian, or equal.

H. RESERVED

2.25 STATION (WS) CUSTOM GRAPHIC SCREENS

A. **General:** All process graphic displays shall reside in non-volatile or battery-backed RAM/DRAM memory resident in each workstation (WS) and be updated in accordance with the display response time requirements specified herein. All process graphics shall utilize advanced graphic features such as isometric representation of process equipment, tanks, and flow lines; line-fills which use the dynamic movement of color and patterns to

indicate the current process flow routing in pipelines or channels; permissive dialog boxes which itemize all of the permissives, and their current state, associated with control strategies related to the currently displayed process graphic. All graphics shall be stored in non-volatile memory and shall be updated in conformance with display response times stated herein. The DESIGN-BUILDER shall furnish process graphics, with each graphic containing a minimum of (a) 5 analog or calculated variables, (b) 15 discrete status information points used to annotate equipment status coloration, (c) 5 fields of conditional text which are generated by discrete alarms and high/low current trips associated with analog values discrete and current trips, (d) 7 process equipment/tank shapes, drawn in an isometric format, which are color annotated by associated status and alarm conditions, (e) 3 instrument shapes, (f) 10 main process lines, drawn in an isometric format, which are dynamically filled by the detection of an associated device's active status, (g) 5 poke points which are used to invoke displays associated with control stations for process equipment, displays which list the status of all permissives associated with a particular control routine or process equipment device, or preformatted trend displays. These custom graphics which do not include template graphics (such as trends, manual/auto (M/A) stations or other generic graphics required for this project), shall typically incorporate a total of 30 variables for each process graphic. Graphics shall be built in accordance with the existing Graphics Criteria, and further defined in a series of Graphics User group meetings if required.

B. **Display Hierarchy**: Each WS shall be configured with displays arranged in a hierarchical manner which enable rapid movement between various levels via paging or other logic oriented functions. The hierarchy shall apply to both process and system oriented displays. Each WS shall, as a minimum, be configured in conformance with a hierarchy consisting of the following displays levels:

1. Global level
2. Regional level
3. Group level
4. Loop level
5. Component level

C. **Process Global Display Layer**: The process global display layer shall be a level of display which presents a department-wide overview. Process Global Displays shall consist of a series of pages which:

1. Depict system, date, time and status on all displays.
2. Graphically depict, in an algorithm diagram format, each on-site and off site regional plant process area and the logical association between each area.
3. Indicate the current and historical operational level based on percent of capacity.
4. Indicate the current and historical energy efficiency based on connected load. An X-Y plot of operational versus energy efficiency shall be displayed.
5. Itemize each process area which currently exhibits alarms of a given priority (E.G., separate listings of priority No. 0,1, 2, 3 alarms associated with each area).
6. Presents a main menu which lists all process regions or areas. The operator shall be able to use this menu to page or link down to the Process Regional Display Layer.

D. **System Global Display Layer:** The system global display layer shall be a level of display which shall depict the current status and "health" of all on-site and off-site DCS components. System Global Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.
2. Graphically depict the on-line, off-line, backup and failure status of all devices.
3. Indicates the accumulate run time for each device. For those devices which have backup controllers, the accumulated run time for on-line mode operation shall be indicated for each controller.
4. Indicate the availability of each device or component for which a run time is being accumulated. This display shall also indicate the availability for the entire system. All calculations to support the availability calculations shall be in conformance with these specifications. These calculations shall be distributed throughout the system to preserve the calculations integrity.
5. Indicate all system diagnostic results including time-out response, allocated time to transmit and actual time to transmit.
6. Indicate all system alarms, and their associated priority, which have occurred in the previous 24 hours.

E. **Process Regional Display Layer:** The process regional display layer shall be a level of display which presents a detailed view of a prescribed process area. Process Regional Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.
2. Present a deviation overview which displays, in bar graph form, the deviation of this area's key process variables from their corresponding set points. All loops which have exceeded a prescribed deviation shall have their respective bar graph change color.
3. Presents a bar graph depiction of all process variables engineering values with their associated alarm limits being indicated. If a variable has exceeded in rate or absolute alarm limit, the bar graph shall change color.
4. Presents a display, in an isometric PID ID format, which illustrates all of the process equipment and instrumentation associated with this area. All process graphics shall be drawn in an isometric format and shall depict critical engineering values, all equipment status indicated by conditional text and color, and all process lines shall be dynamically filled with the appropriate color when flow is detected or equipment is active. All operator actions shall be pokable. These displays shall also incorporate the windowing of trend and X-Y plots.
5. Presents an alarm and event history of all area alarms or operator interface events. All data shall be annotated by tag names, descriptors, event, occurrence, type of alarm, priority, current value, alarm limits, and alarm status. All unacknowledged alarms shall be annotated in a reverse video format.

F. **System Regional Display Layer:** The system regional display layer shall be a level of display which shall depict the current status and health of each DCS component within a prescribed process area. System Regional Displays shall consist of a series of pages which:

1. Depict system date, time and status on all system displays.
2. Graphically depict the on-line, off-line, backup and failure status of all devices.

3. Indicates the accumulated run time for each device. For those devices which have backup controllers, the accumulated run time for on-line mode operation shall be indicated for each controller.

4. Indicates the availability of each device or component for which a run time is being accumulated. This display shall also indicate the availability for the entire system. All calculations to support the availability calculations shall be in conformance with these specifications. These calculations shall be distributed throughout the system to preserve the calculations' integrity.

5. Indicate all system diagnostic results, including time out response, allocated time to transmit, and actual time to transmit.

6. Indicate all system alarms, and their associated priority, which have occurred in the previous 24 hours.

7. Present a graphic depiction of all of the printed circuit boards associated with a particular device. All boards which have failed diagnostics shall be alarmed and be annotated by a change in color.

8. Present a board-level diagnostic fault display analysis which itemizes the specific cause for fault assignment. All descriptions shall be English language devoid of computer terminology.

9. Present a graphical input/output display which enables the detection of a problem or failure down to the point level. This display shall also indicate A/D and D/A performance, accumulated run times per board and availability per board.

G. **Process Group Display Layer**: The process group display layer shall be a level of display which presents the operator with information on and a means to control key variables and equipment within the prescribed area from which this display was accessed. Process Group Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.

2. Depict bar graphs showing values of set points, alarm limits, control outputs and process variables. All alarms shall be annotated by color change. All values shall be in engineering units.

3. Depict manual, automatic and cascade mode status.

4. Depict, in a graphical format, logic stations which enable the operator to perform logical operations such as opening and closing valves, starting and stopping motors and starting and stopping control sequences. Every control output shall have a dedicated logic station.

5. Depict trend displays which are windowed into displays with associated data.

6. Depict, in an isometric P & ID format, a detailed view of each sub process.

7. Depict In/Out of Service Status for each device.

   a. The OOS assignment shall be made from a button on the pop-up control window for each device.

   b. The Out of Service Status shall be indicated by graying-out the device symbol on the control graphic.

H. **Process Loop Display Layer**: The process loop display layer shall be a level of display which presents an interface for the operator to interact with the process on a loop level. Process Loop Displays shall consist of a series of pages which:

1. Depict system date, time, and status on all displays.
2. Depicts, in a graphical format, M/A control stations for each analog output in the area. This display shall display process variables in engineering units, display controller output in percent, display the mode that the control system is in, display alarm limits in engineering units and in percent output. The display shall enable an operator with proper security clearance to perform any one or all of the following:
   a. Change control modes
   b. Ramp set point
   c. Enter finite value for set point
   d. Delete variable from scan
   e. Change alarm limits
   f. Delete alarm actions
3. Depicts, in a graphical format, a high speed X-Y plot or trend which can be windowed into displays with control status.
4. Depicts control loop tuning displays which are designed to be used by operators, process engineers and instrument engineers. Plant personnel shall be able to use these displays to make step changes, activate/deactivate loops, trend process variable versus output versus response time and perform on-line tuning adjustments. All of these tasks shall require proper security clearance. These displays shall be generated for each loop and shall contain:
   a. A control station displayed in graphical format.
   b. A windowed fast trend X-Y plot.
   c. A listing of all the tuning parameters associated with the loop, (e.g., proportional band, reset rate, derivative rate, etc.)

I. **Process Component Display Layer**: The process component display layer shall be a level of display which presents a highly detailed historical accounting of all major process equipment, all DCS components and all field analog devices. Process component displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.
2. Graphically depict the current status of each process equipment device which utilizes over 5 HP or more on a dedicated P&ID isometric formatted graphic. Each graphic shall display current status, values in engineering units which are associated with the device, alarms, accumulated run time, a history of all past alarms, indication of manufacturer, model number and date of installation of all associated components.
3. Graphically depict the manufacturer, model number, date of installation, accumulated run times, alarm history and availability of each DCS component.
4. Graphically depict the manufacturer, model number, date of installation, drawing reference and calibration data associated with each analog device being installed under this project. Displays shall also have an imbedded alarm history based on process and validity of alarms.

2.26 WORKSTATION (WS)-TREND SUBSYSTEM

A. **General:** A collection of pre-built (preformatted) display fields that show lines (trends) representing changing data values from the real-time database and from the historical database shall be furnished. The Trend Subsystem shall be able to trend any variable in the data base, both analog and discrete.

B. The maximum number of trends shall be limited only by the display storage media capacity. Each trend line shall be capable of at least 600 samples of the process variable. Any CRT shall be able to display any historized variable from any historian in the system. Historical trend data shall be capable of being archived to streaming tape and/or floppy disk to be able to be displayed at any future date.

C. Trends shall represent changing data values from the real-time database, and from the historical database. Trends shall be configured on-line with the Display Configurator, and shall be laid out using the Group Display Configurator. The on-line trend configurator shall be selectable from a Detail display, to allow change of trend area attributes and trend line attributes without disrupting the process.

D. A library of standard trend areas, X/Y plot areas, and profile plot areas which can be copies into any display shall be furnished. The trend areas shall vary in size (resolution) and shall be of two types: real-time and historical. The X/Y and profile plot areas shall also vary in size. The Display Builder and Display Configurator software shall include these areas in user-defined displays, and the Display Configurator shall be used to assign the desired configurable options. Trend areas to include as a minimum:

1. Up to 8 trend lines per trend area representing variable data types (Boolean, signed integer, real, and signed long integer)
2. Tick marks indicating division of the axis
3. Time axis length shall be chosen freely
4. Y-axis scaling shall be independent of its length
5. Off-normal limits shall be available in different colors
6. Background color of a trend area shall be changeable
7. Trend line color shall be changeable per trend line
8. Solid trend shall be drawn instead of a line trend
9. X-Y trend objects (one variable versus another)
10. Reassignment to any process variable in the system

E. Text fields shall be defined and configured:

1. Loop Tag
2. Loop Descriptor
3. Any parameter engineering unit
4. Engineering Unit Descriptor
5. Scroll frequency for an entire trend area (limited to real-time trend objects)
6. Per-trend variable:
    a. High range value
    b. Low range value

c. Value at ruler (for direct readout)

d. Off-normal limits

F. **Real-Time Trending:** Real-time trend areas shall scroll dynamically as data changes occur according to the selected scroll frequency (e.g., 1, 2, 5, 10, 30, 60 seconds). Scrolling and updating of real-time trends start immediately after calling up the display. Real time trends shall be capable of collecting and displaying all 1 second samples without averaging or compression.

G. **Historical Trending:** Historical trend areas shall provide purely historized data from the historical database files, which shall include sample data and reduction group data; archived sample group data and archive reduction group data; restored archive sample group and archive reduction group data from floppy disk or streaming tape. Historical trend variables shall incorporate any data reduction and archiving functions thereof. On-line Historical Trend Area interactions shall include:

1. Selection of parameters to be viewed from the Historian data base.
2. Specification of the high and low scale of the Y-axis for each variable for more or less detail.
3. User definition of the time window (base time and/or time span) specified by the time axis in order to view another portion of the history or to view a portion in more or less detail.
4. Use of a moveable ruler to position and numerically read out historical variables within a displayed time window.
5. Specification of off-normal limits.
6. Zero axis readings.

2.27 WORKSTATION (WS)-X/Y PLOTS AND PROFILE PLOTS

A. **General:** The X/Y plots shall contain two variables which are plotted against each other. These variables shall be real-time data taken from object manager-connectable variables within the system or a file of X/Y pairs. The data points shall be collected at a configured scan rate and displayed as a series of points or markers that can be connected. Color shall be used to designate the latest X/Y pair and previously plotted points. Via the use of colors, file data shall be visually compared to recent real-time data. Plots shall include as a minimum:

1. Background color of X/Y plot shall be changeable.
2. Objects shall be capable of being added to the background area.
3. Style selection of real-time and file plot data
4. Standard grid
5. Multiple colors for representing the most recent data point, real data, and file data.

B. The X/Y plot line attributes for each variable shall include: high scale value, low scale value, and delta change value (for real-time data). Default values for these attributes shall be accessed directly.

C. The profile plot area shall display data accessed from a data array of the following type of data: float, long, integer, or byte. The plot shall display each data point along the X-axis with the value of each point associated with the Y-axis. The profile line shall include: high and low scale values, high and low alarm values, the start and end offset for the data array, and the location to which a selected point value is to be sent. The profile style

shall be either line profile or bar profile and updates occur simultaneously or by exception. Plot shall include as a minimum:

1. Up to 4 lines of bar lines per plot area.
2. A reference line representing the median value for each line
3. Line color specified per lot line under normal conditions
4. Off-normal limits specified in a different color
5. Reference line color
6. Lines or bar lines shall be mirrored along the Y-axis

2.28 AUTOMATICALLY GENERATED DISPLAYS

A. Automatically generated displays shall be fully operational displays, which are presented in three levels of control hierarchy:

1. Station display
2. Control strategy and Algorithm Overview display
3. Detail display

B. A Station Algorithm, shall convey information about the system capacity parameters for a Process Control Module type station. This algorithm shall be installed automatically when the database is downloaded, and provides global data storage for system functions. Information displayed includes: percent of CPU time used for processing input/output, all algorithms and continuous control algorithms; free memory available; Object Manager scanner data; cumulative algorithm processor overruns; total inter-station IPC connections; and peer-to-peer point connection status.

C. To access a control scheme without configuring displays, the operator shall be able to request the Control strategy and Algorithm Overview display. The current level of criticality (the highest priority alarm that exists in any algorithm within the control strategy) and relevant data shall be displayed for each control strategy and algorithm. All alarm information displayed or set by Default Displays shall be received from or sent to Processors. This includes the acknowledged and/or unacknowledged status of the alarms.

D. Displays for individual control strategies shall be accessed from the Compound and Algorithm Overview display. Control strategy displays shall be live displays that allow interaction with all algorithms within a single control strategy. Control strategies from several processors shall be grouped and turned on or off as a group.

E. Detail displays for individual algorithms shall be accessible from the Control strategy and Algorithm Overview, Alarm History and Current Alarm displays. Detail displays shall allow operator manipulation of all valid algorithm parameters. They shall show all connectable algorithm parameters, a faceplate area and a real-time trend area (for continuous control algorithms). In graphic format and in a small area, faceplates shall provide information as to algorithm type and description; measurement, set point, output values; algorithm state and status; alarm condition; auto/manual and remote/local designation. There shall be 3 categories of algorithm types/domains as a minimum:

1. Continuous Control
2. Sequence Control

3. SAMA Logic (Programmable Logic Algorithms)

2.29 PREFORMATTED GROUP DISPLAYS

A. **General:** Preformatted displays provided shall be modified or new ones created through a menu-driven configuration and editing process. Link preformatted displays shall be linked to each other and to graphics to form a user-defined display hierarchy.

B. The group display shall present information for up to 8 control algorithms in a 4-over-4 screen layout. It shall show each algorithm as a faceplate with a unique layout available for each algorithm type. The display shall contain faceplates, trends, or X/Y plots or a combination of all 3. Display Builder and Display Configurator shall be used to edit displays.

C. Sequence algorithms shall be intermingled with Continuous algorithms and PLB algorithms in the group display when required. All control algorithm types/domains shall be supported. Group display interactions shall be performed with screen functions keys. Interactions to include as a minimum:

1. Control and alarm monitoring of algorithms
2. Ramping or numeric entry of set points, ratios, targets, outputs, etc.
3. Toggling discrete values and controller states
4. Requesting the Detail display for a selected algorithm
5. Direct access to the previous display

2.30 INVOKING DEFAULT DISPLAYS

A. Default displays, preformatted displays, and user-defined displays must all be invoked in an identical manner. Any specific pre-defined display shall be assigned to and called from any menu, attached to a hard annunciator key or soft (screen) key, called via an application program, or attached to an active display object with a display.

2.31 ELECTRONIC DOCUMENTATION

A. **General:** Systems documentation shall be provided on the system itself in electronic format. It shall be available as loadable CD-ROMs or DVDs to be run as a separate entity, and as on-line help that is associated with the software functions themselves.

B. Documentation shall be broken down by function and user. Information required by process operators shall be included in a Process Operator's Guide; information required to configure process control algorithms shall be included in Integrated Control documents and shall be geared toward the process engineer.

1. **Loadable Documentation:** Loadable documentation shall provide comprehensive information about hardware and software. It shall consist of text and graphics displayed on the workstation screen. Documentation shall be able to run in its own window concurrently with other applications. Documents shall be accessed via the menu bar pick, with further selections made from another menu and table of contents. Documents shall be picked from an alphabetical list or from functionally organized subgroups. Once a document is selected, choice of reading the entire document, a specific area of interest or list of figures, or an index that shows the document selections that discuss the subject area desired will be made available. Various screen control functions shall be provided as selectable icons displayed at the bottom right of each screen of text. These shall include Next Screen, Previous Screen, Next Section, Table of Contents, Exit, and Return. A distinction shall be made between active and inactive selections using different icons.

2. **Printing Loadable Documentation:** Loadable documentation shall be printed by a special utility that prints all text sections in the document. Each printed page shall contain up to two screens of text.

3. **Embedded Help:** Embedded help shall provide information and assistance for software program/functions. The information shall relate to the current display, current program operation or selection. It shall change as the operator proceeds through the program to provide appropriate information. Help shall be requested by selecting HELP from the menu bar. A menu of topics relating to the current display or selection shall appear on the screen. Selection of a topic from a menu displays the Help text in a partial screen overlay. Screen control functions shall be displayed as selectable icons below each help overlay. They shall be Return, Next Screen, Previous Screen, and Exit Help. For operator guidance, embedded help shall also be user-created to be associated with operational displays.

PART 3 -- EXECUTION

3.1 EQUIPMENT, MATERIALS AND WORKMANSHIP

A. **General:** It is the intent of these Contract Documents to secure high quality in all equipment and materials, and to require first-class workmanship, in order to assure long, trouble-free operation and minimum maintenance of the DCS.

B. Equipment and materials shall be the products of reputable, experienced manufacturers with a verifiable history of manufacturing similar equipment. Similar items in the project shall be the products of the same manufacturer. All equipment shall be of industrial grade and standard construction, shall be of sturdy design and manufacture, and shall be capable of long, reliable, trouble-free service.

C. All work, including calibration, testing, adjustment, start-up and maintenance, shall be done by qualified experienced personnel who are technically skilled in their trade, are thoroughly instructed, and are competently supervised. The resulting completed installation shall reflect professional quality work, employing the highest industrial standards and methods.

3.2 OPERATIONAL READINESS TESTING (ORT)

A. **General:** The complete system, including all, DCS equipment, peripheral devices and interconnecting cables shall be assembled on the DCS manufacturer's test floor, and all programs shall be completely tested under simulated operating conditions. Further tests shall be performed in the field at time of start-up with external sensors and field wiring connected to determine final specification compliance.

B. All hardware test procedures shall strictly conform to the following sections of ISA-RP55.1 - 1975 (R 1983):

1. Section 3: in its entirety
2. Section 4: applicable portions
3. Section 5: in its entirety
4. Section 6: in its entirety
5. Section 7: in its entirety
6. Section 8: in its entirety
7. Glossary - CMR test configuration
8. Glossary - NMR test configuration

9. Glossary - Noise measurement configuration

10. Appendix A - Analog Input Subsystem Accuracy

C. Three certified copies of all test data and results shall be submitted to the CONSTRUCTION MANAGER. All test documentation and results shall comply with ISA-RP55.1-1975 (R1983) Type 2 and type 3 documentation as described in section 10.2 of the referenced standard.

D. The equipment shall be operationally tested for compliance with the conditions of these Specifications. ORT set-up shall include simulated inputs. On line configuration of the monitoring and control loops using simulated inputs shall be demonstrated without error or malfunction. Logs and report generation capability shall be demonstrated by simulating process inputs and manually entering data.

E. The DESIGN-BUILDER shall submit a detailed ORT specification to the CONSTRUCTION MANAGER at least 6 weeks in advance of commencement of the ORT. The CONSTRUCTION MANAGER shall be notified at least 30 days in advance of the ORT and reserves the right to have his representatives in attendance.

F. Each item of equipment shall be fully inspected, calibrated and tested for function, operation and continuity of circuits as applicable. Exceptions shall be approved in writing from the CONSTRUCTION MANAGER.

G. System performance shall be tested using a complete integrated system including all peripheral devices and interconnecting cables assembled on the test floor, complete operational programs loaded, and simulated inputs applied. The DESIGN-BUILDER shall carry out a 100-hour full system test during which the entire system shall operate continuously without failure, all in accordance with the requirements of the specifications and drawings. If a system component fails during the test, the 100-hour test period shall be restarted after its operation is restored.

H. After successful completion of the factory test, 3 certified copies of all test results shall be furnished to the CONSTRUCTION MANAGER together with a clear and unequivocal statement that all ORT requirements have been met. The CONSTRUCTION MANAGER will give written notice of the acceptability of the ORT within 30 days of receipt of the ORT results.

I. Three CONSTRUCTION MANAGER/OWNER Representatives shall witness the ORT and at least 30 working days written notice shall be given prior to date of starting tests. One copy of each acceptance test procedure shall be submitted to the OWNER 30 days prior to the start of the acceptance test.

J. In the event that the system does not function as specified, it shall be modified at the factory to meet the specification requirements, and shall be retested as specified herein. Costs for all such retesting and witnessing shall also be borne by the DESIGN-BUILDER.

All of the CONSTRUCTION MANAGERS/OWNER's travel and per diem costs associated with all ORT testing and retesting shall be borne by the DESIGN-BUILDER.

K. Prior to installation, all DCS highway and DIN cable shall be ORT by the DESIGN-BUILDER to verify that the attenuation does not exceed prescribed limits and to ensure that concealed or internal discontinuities which could cause reflections do not exist. In conformance with the submittal requirements of these specifications, the DESIGN-BUILDER shall submit certified test reports which contain the following data:

1. Dielectric constant

2. Outside diameter of inner conductor

3. Inside diameter of outer conductor

4. Attenuation constant

5. Plot of each cable attenuation-frequency response per 100 feet of cable.

6. All datalinks, which shall be the final hardware, application software, and Modbus addresses installed in the field shall be tested during the operational readiness test.

3.3 INSTALLATION SUPERVISION

A. General: The DESIGN-BUILDER shall provide personnel to properly oversee the installation of all DCS equipment performed by others. Subsequent to the installation of all DCS equipment, the DESIGN-BUILDER shall certify to the OWNER that the DCS has been properly installed.

B. The DESIGN-BUILDER shall furnish the services of trained engineer(s) to check the completed installation and to make all necessary adjustments for satisfactory operation of the DCS. There shall also be furnished complete installation drawings and instructions in accordance with these Specifications.

3.4 CALIBRATION

A. **General:** The DESIGN-BUILDER shall calibrate the complete system after installation. This shall ensure that those components having adjustable features are set carefully for the specific conditions and applications of this installation and that the components and systems are within the specified limits of accuracy. Defective elements which cannot achieve proper calibration or accuracy, either individually or within the system, or subsystem, shall be replaced.

1. Analog input channels shall be verified at 25 percent, 50 percent and 75 percent of span by applying simulated analog test signals. Applied test data shall be processed by the associated PCM using programs assigned to the particular data channels being simulated with the resulting engineering unit data presented on a CRT display. At least one simulated analog signal shall be routed through each analog-to-digital converter. The accuracy of the analog-to-digital converters and data processing activities shall be verified at each calibration step for each channel being simulated by comparing the known input against the Root Mean Square Summation tolerances calculated for each engineering unit data value noted.

2. The accuracy of all digital-to-analog converters shall be verified by manually entering engineering unit data values at the WS and then reading and recording the resulting analog output data. All analog output data shall be compared against calculated Root Mean Square Summation tolerance requirements.

3.5 TESTING OF FIBER OPTIC CABLE INSTALLATION

A. **Acceptance Testing**: The DESIGN-BUILDER shall perform pre-installation and post-installation fiber optic cable acceptance tests of cable installed by others. The CONSTRUCTION MANAGER shall be notified a minimum of 5 days in advance so they may have the opportunity to witness the tests. Each of these tests is described as follows;

1. **Pre-installation tests:** Prior to the installation of cable, the DESIGN-BUILDER shall perform the following test;

a. The purposes of these tests is to perform acceptance tests on the shipped cable prior to installation in order to validate that the cable conforms to the

manufacturers specifications, and is free of defects, breaks, and damages caused by transportation and manufacturing processes. The DESIGN-BUILDER shall perform all tests on all reels of cable. These tests shall be documented and submitted to the CONSTRUCTION MANAGER for review. Subsequent to the receipt of the CONSTRUCTION MANAGERS approval, the cable shall be available for installation.

b. The tests shall measure a total attenuation or loss for each fiber on each cable reel and document results of physical inspections to identify any cable and reel damage conditions, less or more than the specified fibers in the cable, and any deviations from the manufacturer's specifications.

2. Post-Installation Tests: The DESIGN-BUILDER, upon completion by others of the fiber optic cable installation and splicing, shall perform the following tests;

a. Double-ended loss test per EIA/TIA 568 Appendix H: OFSTP-14 (Optical Fiber Test Procedure 14.) Method B

b. Measurements for each fiber shall be documented and provided to the CONSTRUCTION MANAGER

c. Any fiber, connectors or other components which do not meet the requirements of EIA/TIA 568 B3 (including standards incorporated by reference) shall be removed and replaced at the expense of the DESIGN-BUILDER. Fusion splices shall not have a loss of more than 0.3 dB. Multimode splices must have a return loss of better than 20 dB. Single mode splices must be better than 26 dB ORL. Requirements for loss are:

Fiber Type	Wavelength (nm)	Max Attenuation Coefficient (dB/km)	Bandwidth (MHz-km with overfilled launch)
50/125	850	3.5	500
	1300	1.5	500
62.5/125	850	3.5	160
	1300	1.5	500
Singlemode(Premises)	1310	1.0	NA
	1550	1.0	NA
Singlemode(Outside Plant)	1310	0.5	NA
	1550	0.5	NA

d. Upon completion of the previous tests, all fiber optic cable coils shall be secured with ends capped to prevent intrusion of dirt and water.

3.6 INSTALLATION TEST

A. **General:** The DESIGN-BUILDER shall be responsible for the oversight of installation of all DCS equipment being furnished under this project. If a DCS device (including network cables) has been installed by others in a faulty manner, the DESIGN-BUILDER shall notify the CONSTRUCTION MANAGER. Systems shall be exercised through operational tests in the presence of the CONSTRUCTION MANAGER in order to demonstrate achievement of the specified performance.

B. A complete integrated distributed control system test shall be performed. All modes of operation and man/machine interactions shall be exercised. Compliance to specified system failure detection and failover requirements shall be verified by selectively disabling individual LCDs, common logic files, data communication equipment and data links. Compliance to signal failure detection and response requirements shall be verified by employing analog test equipment to apply excessive signal amplitude and rate-of-change values. All data communication equipment shall be thoroughly tested for function and accuracy.

C. The results of all DCS installation test activities shall be documented. All analog-to-digital converter and digital-to-analog converter accuracy tests shall be documented on test forms, approved by the CONSTRUCTION MANAGER, which include calculated Root Mean Square tolerance limits for each calibration step.

D. Upon the satisfactory completion of all DCS installation tests, a certified report, including all test documentation, shall be furnished to the CONSTRUCTION MANAGER together with a clear and unequivocal statement that the installed system has been successfully calibrated, inspected and tested. The CONSTRUCTION MANAGER will give his acceptance of the installation tests within 10 days of his personal receipt of the test report if the results of the computer installation tests are acceptable.

3.7 SYSTEM COMMISSIONING AND PERFORMANCE TESTING

A. **General:** System commissioning and performance testing shall comply with the provisions specified herein and the Contract Drawings and Specifications. Further, system commissioning and performance testing shall commence after all installation tests and inspections have been conducted and accepted in accordance with the following B, C, D, and E, and shall demonstrate that all components of the control system can meet all contract requirements with the equipment operating over full operating ranges under actual operating conditions.

B. All commissioning and test activities shall follow detailed test procedures, and check lists, previously reviewed by the CONSTRUCTION MANAGER. All tests data shall be acquired using equipment as specified and recorded on test forms, previously reviewed by the CONSTRUCTION MANAGER, which includes calculated tolerance limits for each calibration step. Completion of all system commissioning and test activities shall be documented by a certified report, including all test forms with tests data entered, delivered to the CONSTRUCTION MANAGER with a clear and unequivocal statement that all system commissioning and test requirements have been satisfied. The CONSTRUCTION MANAGER will give his acceptance of the system commissioning and test activities within ten days of his personal receipt of the report if the report is accepted.

C. The proper control of all final control elements and control panels shall be verified by tests conducted in accordance with the requirements specified herein. Where feasible system commissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent practicable, normal final control element 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 the distributed control system and local field mounted control circuits. All hardwired 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 modes. The stable steady-state operation of final control elements running under the control of field mounted automatic analog 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 field mounted 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.

D. All control stations incorporating proportional, integral and/or differential control circuits shall be tuned experimentally, by applying control signal disturbances and adjusting the gain, reset and/or rate setting(s) as required to achieve a proper response. Measured final control element variable position/speed set-point settings shall be compared to measured final control element position/speed values at 25 percent, 50 percent and 75 percent of span and the results checked against specified accuracy tolerances. Specified accuracy tolerances are defined as the root-mean-squaresummation of individual component accuracy requirements. Individual component accuracy requirements shall be as specified in the Contract or as specified by published manufacturer accuracy specifications whenever Contract accuracy requirements are not specified.

E. Subsequent to the performance testing of process/process equipment furnished by others, the DESIGN-BUILDER shall conduct a successful 30 day performance test for the distributed control systems furnished under this contract. In the test, the entire DCS shall be continuously operated and maintained (i.e., 7 days per week, 24 hours per day) during the test period with zero downtime resulting from system failures. If a system failure occurs, the 30 day test shall be considered a failure and not acceptable. The DESIGN-BUILDER shall reinitiate the 30 day test. The DCS shall be acceptable only after all equipment has satisfied the performance test requirements and demonstrated a system availability of 99.98 percent.

F. The system availability shall be calculated based on the following equation:

$$A = (MTBF \times 100\%) / (MTBF + MTTR)$$

where, A = system availability in percent

MTBF = average time interval between consecutive system failures

MTTR = average time required to repair system failure

G. Downtime resulting from the following shall be considered system failures:

1. Downtime of any system component which is automatically "backed-up" and the back-up unit fails to automatically assume control within the specified time or if a component failure cannot be repaired/replaced within 2 hours.
2. Downtime of any component (exclusive of I/O) whose failure results in the inability of the Operator to monitor and manipulate control loops from the associated EC/OC using standard man-machine interface procedures.
3. Downtime resulting from the concurrent failure of any 2 workstations, or any 2 operator workstation input devices associated with the same workstation.
4. Downtime in excess of 2 hours resulting from any I/O component failure.
5. Downtime resulting from concurrent failure of 2 or more I/O components in a single PCM.
6. Downtime of any component/peripheral associated with the Historian if the failed component (1) results in a disabling of the historical functions and (2) the failed component is not repaired or replaced within 8 hours.

H. The DESIGN-BUILDER shall submit a performance test completion report which shall state that all Contract requirements have been met and which shall include (1) a listing of all DCS equipment maintenance/repair activities conducted during testing and (2) a listing of all components which were unable to operate successfully. Final acceptance, in writing, of the DCS will be provided by the CONSTRUCTION MANAGER if the results of all of the performance tests are acceptable.

I. The DESIGN-BUILDER shall guarantee the required availability of the entire distributed control system for a period of one year after acceptance of all required performance tests. The DESIGN-BUILDER shall be responsible for furnishing and maintaining the spare parts/tools on-site at an inventory level it determines is sufficient to achieve the system availability requirements specified herein. All spare parts/tools stored on-site shall become the property of the OWNER upon completion of the guarantee period. If the DCS does not comply with the availability requirements stated herein within the first year of system operation, the DESIGN-BUILDER shall forfeit that amount of the performance bond equal to the replacement cost of the entire DCS bid under this contract. The DESIGN-BUILDER shall guarantee the following:

1. The completed system shall perform all of the data acquisition, control, and reporting functions as shown and specified.

2. The availability of the entire distributed control system shall not be less than 99.98 percent with a mean time to repair (MTTR) of 2.0 hours for any consecutive period of 6 months during the guarantee period. Availability, MTTR and other supporting terminology shall be as defined in SAMA Standard PMC 32.1-1976.

3.8 TRAINING OF PERSONNEL

A. **General:** The DESIGN-BUILDER shall furnish training for the purpose of familiarizing OWNER's personnel with the distributed process control systems. Training shall be provided at the Department Headquarters or at the facility. All DH training shall be complete with all materials, resumes, test equipment, etc., that is normally associated with training offered at the DCS manufacturer's facilities. None of the courses detailed here shall overlap. Courses shall be scheduled in series so as to allow the same personnel to attend more than one training course. The training shall be scheduled a minimum of 60 days in advance of when they are to be given. Proposed training materials, including a detailed training agenda itemizing relative emphasis on various topics of each course, shall be submitted to the CONSTRUCTION MANAGER at least 60 days in advance of when the course is to begin. The CONSTRUCTION MANAGER shall review this outline and provide comments that shall be incorporated into the course.

B. In addition to providing training in the operation and maintenance of equipment manufactured by the DCS manufacturer, there shall be training courses covering all items which are manufactured by others. Each of the courses (both at the Department Headquarters and on-site) shall be taught by authorized representatives of each respective equipment manufacturer. Each manufacturer's representative shall be fully knowledgeable in the operations and maintenance of their equipment and shall be a full-time instructor under the employ of the respective manufacturer.

C. Within 60 days of receipt of Notice to Proceed, the DESIGN-BUILDER shall submit a training plan which contains, as a minimum, course outlines and schedules for training to be provided at the DCS manufacturer's facility.

D. RESERVED

E. Courses with Course Numbers beginning with MWWD are customized courses, and shall be as follows:

1. MWWD-01 - Basic MWWD Operator Training:

   a. General: This course shall be intended for all operations personnel who will be using the DCS to interface and monitor the facilities. This course shall be customized for the provided system.

   b. Objective: This course shall be designed to give the student the ability to monitor and control the plant at Operator Level 2.

   c. Prerequisites: There shall be no prerequisites for this course.

   d. Course Objectives: Upon successful completion of this course, using the reference material provided, the student shall be able to:

      1) LIST the major components of the system

      2) DESCRIBE the function of the menu bar

      3) USE the Process Diagram subsystem to display graphics

      4) UTILIZE the functions available from the menu subsystem

      5) EVALUATE point alarm conditions through the use of the Alarm subsystem

      6) MONITOR the process by utilizing the Live Trend subsystem

      7) DIAGNOSE process problems with the Historical Trend subsystem

      8) INTERFACE to control through the use of the Process Diagram subsystem

   e. Course Length: 2 days

2. RESERVED

   a. RESERVED.

   b. RESERVED

   c. Course Objectives: Upon successful completion of this course, using the reference material provided, the student will be able to:

      1) RESERVED

      2) RESERVED

      3) RESERVED.

      4) RESERVED

      5) RESERVED

      6) RESERVED

F. In addition to providing classroom instruction, the DESIGN-BUILDER shall furnish each training course in electronic format. The content of the electronic training shall be identical to that used in the classroom.

3.9 MAINTENANCE REQUIREMENTS

A. **General:** The DESIGN-BUILDER shall maintain in complete operation the DCS furnished under this Contract for a period of one year from the date of the successful completion of the final 30 day performance test. All hardware required in the first year of this maintenance contract shall be covered by system warranty provisions. Maintenance personnel provided by the DESIGN-BUILDER shall instruct the OWNER's

personnel in the operation, adjustment, calibration and repair of equipment being serviced.

B. Independent of this agreement, the DESIGN-BUILDER shall maintain and permit OWNER utilization of various DCS components which have successfully completed 30 day performance tests until the entire DCS has been successfully tested and accepted with each component in service being applied to its respective full intended usage. During this interim period between component utilization and system acceptance, (i.e., from the time of the completion of the System overall DCS (test) the DESIGN-BUILDER shall maintain the utilized components in conformance with the requirements herein.

C. Corrective hardware maintenance shall be performed by factory-trained service technician(s) specifically trained for the digital equipment to be serviced. Technician(s) possessing suitable training and experience shall be provided to perform corrective maintenance on all other equipment. The hardware service technician(s) shall be on-site within 4 hours after notification by the OWNER. The service technician(s) shall be available for call 8 hours per day, 7 days per week.

D. Corrective system software maintenance shall be performed for all software provided by the DESIGN-BUILDER and incorporated into the system prior to system acceptance. Software service programmers shall be available for call 8 hours per day, 7 days per week and on-site within 12 hours after notification by the OWNER. All preventative and corrective maintenance activities shall be performed at no extra cost to the OWNER and shall be documented with service reports which identify the equipment (or program) being serviced, condition of the equipment, description of all work performed, listing of all materials used, and the name and signature of the OWNER's representative attesting to the accuracy of the report. A copy of all service reports shall be delivered to the OWNER on the day work is performed.

E. Preventative hardware and software maintenance shall be performed at scheduled intervals to provide a dependable and operational system. A copy of all service reports shall be delivered to the OWNER on the day the work was performed.

F. As part of the Maintenance Contract, the DESIGN-BUILDER shall provide Remote Diagnostic Support Service for on-line system performance analysis. The DESIGN-BUILDER shall provide all required hardware to electronically connect the DCS to the DCS manufacturer's main factory and local service facility, herein referred to as the DCS manufacturer's service facilities, to enable the DCS manufacturers service specialists to assist in diagnosing application and system malfunctions. A quarterly report detailing the performance of the system, generated by the DCS manufacturer's Remote Diagnostic software, shall be delivered to the OWNER in conjunction with scheduled preventive maintenance visits.

G. RESERVED

1. RESERVED
2. RESERVED
3. RESERVED

H. OWNER may have the option of adding this work to the existing Maintenance Contract already in place after successful completion of the final 30 day performance test.

3.10 SPARES, TOOLS AND TEST EQUIPMENT

A. **General:** The DESIGN-BUILDER shall furnish all spare parts, tools and test equipment required to repair and calibrate the DCS and maintain it in good operating condition.

B. RESERVED

C. The DESIGN-BUILDER shall provide the following spare parts and supplies in a quantity sufficient enough to maintain the DCS for a period of 2 years. Actual spare part requirements shall be based on each component published MTBF. As a minimum, spare parts and supplies shall include:

1. RESERVED
2. RESERVED
3. RESERVED
4. RESERVED
5. RESERVED
6. RESERVED

3.11 SOFTWARE DOCUMENTATION

A. Software documentation shall be delivered to the OWNER prior to the final acceptance at which time all programs shall have been tested, delivered, and fully operational. The Owner retains all rights to programming and software configurations developed, performed, and implemented under this project. The DESIGN-BUILDER must obtain the Owner's consent prior to reuse of project software. Each set of documentation shall include, but not be limited to, the following:

1. General description of the overall purpose of each program with any assumptions or restrictions fully explained. Format for any input and/or output messages shall be included.
2. Abstracts describing the operational objectives of each major program section together with an explanation of its relationship to other major program sections.
3. A complete listing all of hardware devices which comprise the DCS. The listing shall include manufacturer, model number, physical location and hardware address.
4. A complete listing of all of the tag numbers in the DCS along with associated description information and hardware addresses.
5. A complete listing of all specialized interface functions that are associated with each system function, tag, or operator function.
6. Complete documentation on all system and process displays including a graphical depiction of the hierarchy with linkages shown, definition of security levels associated with each display, a listing and hard copy of all displays and formats.
7. Complete copy of system data base organized by PCM.
8. Complete set of all software configurations implemented for data acquisition, control, and alarming purposes. Data shall include both text and graphic depictions. All software listings shall be fully annotated with as-built data.
9. A complete list of SAMA drawings/control sheets for the entire project.

**** END OF SECTION ****

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 09800 Protective Coating
3. Section 11000 Equipment General Provisions
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. Uniform Mechanical Code
2. Uniform Plumbing Code
3. Uniform 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:

1.	ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
3.	ANSI/ASME B31.1	Power Piping
4.	ANSI/AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
5.	ANSI/AWWA C150	Thickness Design for Ductile Iron Pipe
6.	ANSI/AWWA C153	Ductile Iron Compact Fittings, 3 In through 24 In and 54 In Through 64 In for Water Service
7.	ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in. Through 144 in.

8.	ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
9.	ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In Through 12 In for Water Distribution
10.	ANSI/AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In through 36 In
11.	ANSI/AWS D10.9	Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing
12.	ASTM A 123	Specification for Zinc Coatings on Iron and Steel Products
13.	ASTM A 536	Ductile Iron Castings
14.	ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
15.	ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 and steel tubing:** 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. 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. Lightweight stainless steel pipe shall be Type 316 Schedule 10 pipe conforming to ASTM A 312, with stainless steel welding fittings. 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.

B. **Pipe Supports:** Pipes shall be properly supported in accordance with Section 15020.

C. **Coating:** Pipes above ground or in structures shall be field-painted in accordance with Section 09800.

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.

F. **Insulating Flange Sets:** Insulating flange sets shall be provided where indicated and shall consist of insulating gaskets, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2-inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2-inch, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic. Steel washers shall comply with ASTM A 325. Insulating gaskets shall be full-face.

G. **Flange Gaskets:** Gaskets for flanged joints shall be full-face, 1/16-inch thick sheets of virgin graded teflon, 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, 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

A. Linear Expansion Only: Use expansion loops, bellows-type expansion joints, or sliding type expansion joints of ductile iron, stainless steel, monel, or rubber.

B. Linear, Angular, and Lateral Movement: Use flexible expansion joints consisting of expansion sleeve and ball-and-socket joints in a single unit. Each unit shall be capable of minimum 15 degrees angular motion in any direction, and the expansion sleeve shall be capable of minimum 4 inches of linear travel. Joints shall be suitable for the pressure and temperature application and be ductile iron conforming to ANSI/AWWA C153. All surfaces containing pressure and sealing surfaces shall be coated with minimum 15 mils of fusion bonded epoxy conforming to ANSI/AWWA C213.

2.8 PIPE THREADS

A. Pipe threads shall comply with ANSI/ASME B1.20.

2.9 PIPE INSULATION

A. Hot and cold liquid piping, flues, and engine exhaust piping shall be insulated where indicated, in accordance with Section 15250.

2.10 AIR AND GAS TRAPS

A. Air and gas pipes shall be sloped to low points, provided with drip legs, strainers and traps. The traps shall be piped to the nearest drain. Air and gas traps shall be 150-lb iron body float type with copper or stainless steel float. Bracket, lever, and pins shall be of stainless steel.

2.11 STEAM TRAPS: Not Used

2.12 GLASS LINING

A. **General:** Ductile iron or steel pipe and fittings shall be glass-lined where indicated. The glass lining shall be suitable for handling sewage, primary sludge, digested sludge, and scum. It shall be smooth, continuous, and suitable for prevention of grease and foam build-up. The glass lining shall be capable of withstanding thermal shock of 430 degrees F to 800 degrees F without crazing, blistering, or spalling.

B. **Criteria:** The glass lining shall consist of a vitreous material selected to meet or exceed the following criteria:

1. Unaffected by scraping with a sharp knife, simulating the effects of rodding.
2. Unaffected by the continuous application of live steam from a steam generator, immediately followed by a cold water quench.
3. Unaffected by an 8 percent sulfuric acid solution at 148 degrees F for a ten-minute period.
4. Minimum thickness: 10 mils by micro test.
5. Spark tested: Surface must be free of pinholes.
6. Hardness: 5-6 Mohs.
7. Density: 2.5-3.0 g/cu cm, measured by ASTM D 792.

C. **Application:** Cast or ductile iron pipes and fittings shall be bored or machined smooth to remove voids or protrusions. Steel pipe shall be seamless pipe, with all internal fitting welds ground smooth, slag holes ground out, re-welded, and ground smooth. Interior surfaces shall be grit blasted to white metal and lining fused to chemically clean metal at above 1400 degrees F. Welded flanges shall be factory-installed before lining. Threaded flanges of cast and ductile iron pipes shall be installed after lining and shall be sealed and tested prior to shipment.

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, Style 3000

3. Steel Pipe Couplings:

   Gustin-Bacon (banded or grooved)
   Victaulic Style 41 or 44 (banded)
   Victaulic Style 77 or 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. Air and Gas Traps:

   Armstrong Machine Works
   Spirax Sarco, Inc.

8. Glass Lining:

   The Pfaudler Co., Inc.
   A.O. Smith Corp.
   Waterworks, Inc.

PART 3 -- EXECUTION

3.1 GENERAL

A. Pipes, fittings, and appurtenances shall be installed in accordance with the manufacturer's installation instructions.

B. Threaded pipe ends and joints shall be epoxy coated in compliance with Section 09800.

**** 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:

1.	ANSI/ASME B31.1	Power Piping
2.	ANSI/MSS SP-58	Standard Pipe Support Components

1.4 SHOP DRAWINGS AND SAMPLES

A. Submittals shall comply with Section 2-5.3.1 of the Supplementary Special Provisions and Section 15000 and shall include:

1. Shop drawings of pipe supports including details of concrete inserts.

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. 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
			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 Schedule 80 Polypropylene Pipe:

Pipe Size	inches	Max Span (@ 100 degrees F)	feet
	1/2		3
	3/4		3
	1		3
	1-1/4		4
	1-1/2		4
	2		4
	3		5
	4		6

6	7
8	8
10	8
12	9

5. Support Spacing for Fiberglass Reinforced Plastic Pipe:

Pipe Size inches	Max. Span (@ 100 degrees F) feet
2	8
3	10
4	11
6	12
8	13
10	14
12	15
14	16
16	17
18 & Above	18

6. 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
	Span, L-ft									
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.

7. Support Spacing for Ductile Iron Pipe:

Pipe Size	Max. Span
All Sizes	2 Supports per length or 10 feet (One of the 2 supports located at joint)

8. Variances: 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.

9. Additional Supports: Additional supports complying with ANSI B31.1 shall be provided at critical elbows, valves, gauges, and meters.

D. **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.

E. **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.

F. **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.

G. **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.

H. **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.

I. **Riser Supports:** Risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

J. **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.

K. **Submerged Supports:** Submerged piping shall be supported with hangers, brackets, clips, or fabricated supports and stainless steel anchors complying with Section 05500.

L. **Point Loads:** Meters, valves, heavy equipment, and other point loads on PVC, fiberglass, and other plastic pipes, shall be supported on both sides according to manufacturer's recommendations to avoid pipe stresses. Supports on plastic and fiberglass 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 deigned 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 UBC 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.

B. **Other Coatings:** Other than stainless steel or non-ferrous supports, supports shall be coated in accordance with Section 09800.

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. Section 09800 Protective Coating
2. 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:

1.	ANSI A13.1	Scheme for the Identification of Piping Systems
2.	ANSI Z535.1	Safety Color Code
3.	MIL-STD-810	Environmental Test Methods and Engineering Guidelines
4.	NFPA	Guide to Hazardous Materials
5.	NFPA 704	Hazard Identification System
6.	UFC 79-3	Identification of the Health, Flammability and Reactivity of Hazardous Materials
7.	29CFR 1910.106	Flammable and Combustible Liquids (OSHA)
8.	29CFR 1910.145	Specification for Accident Prevention Signs and Tags (OSHA)
9.	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):

1.	CCR, Title 8, Section 537	Piping Systems Valving and Labeling (Cal-OSHA)
2.	CCR, Title 8, Section 3321	Identification of Piping (Cal-OSHA)
3.	CCR, Title 8, Section 5194	Hazard Communication (Cal-OSHA)

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 in accordance with Section 09800 and providing marker lettering and color banding as indicated. 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. Certain pipe indicated in paragraph 3.5 also 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 type 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 180 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

Not Used

2.4 EXISTING IDENTIFICATION SYSTEMS

A. In installations where existing piping identification systems have been established, the DESIGN-BUILDER 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., "DHWR-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 BURIED PIPE

Not Used.

3.5 EXPOSED PIPE IDENTIFICATION SCHEDULE

A. DESIGN-BUILDER shall match existing pipe identification colors and patterns as closely as possible. Marker lettering shall match existing lettering. A complete list can be obtained from the CONSTRUCTION MANAGER upon request.

**** 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
2. Section 15100 Valves, General

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. Uniform 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:** Gauges attached to systems containing chemical solutions, corrosive fluids, sludge, sewage, or other liquids containing solids, shall be equipped with diaphragm seals, or equal protective pressure or vacuum sensing devices, and comply with the following:

1. For: sewage, sludge, liquids containing solids, pulsating flow	Seals shall be fabricated with Type 316 stainless steel, with stainless steel diaphragm for pressures over 15 psi, and elastomer diaphragm for pressures of 15 psi and below with Type 316 stainless steel nuts and bolts, fill connection and valved flush port size 1/4-inch NPT, capable of disassembly without loss of filler fluid.

2.	For: chemical solutions, low pressure sewage and chemical sludge except as otherwise indicated	Seals shall be fabricated with PVC body for removable mounting and rated at 200 psi, with Type 316 stainless steel bolts and nuts, 1/2-inch inlet, 1/4-inch outlet, liquid-filled with Teflon diaphragm for pressure service and proper elastomer diaphragm for vacuum service.

2.2 SLEEVE PRESSURE GAUGES

A. **General:** Sleeve pressure gauges shall be provided for sewage, sludge, solids bearing liquids in place of diaphragm seal gages where indicated. Flanges shall be patterned to match the piping system.

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 at 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

2. Diaphragm seals shall of the following manufacture and model (or equal):

   a. Stainless steel diaphragm seals and elastomer diaphragm seals for sewage, sludge and liquids containing solids.

      Ashcroft, model 101
      Marshalltown, Series 225-01
      U.S. Gauge (Ametek), SG

   b. Silver diaphragm seals for chlorine and sulfur dioxide under pressure.

      Fischer and Porter
      Pennwalt (W&T)

   c. Teflon diaphragm and elastomer diaphragm seals for chemical solutions, low pressure sewage, and chemical sludge.

Harrington Ind. Plastics, Inc.
Plast-O-Matic Valves, Inc.
Utilities Supply

3. Snubbers shall be manufactured by one of the following (or equal):

Cajon Company
Weksler Instruments, Corp.

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 15100 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for valves including epoxy coating, installing, adjusting, and testing of valves and where buried valves are indicated, valve boxes to grade, with covers, stem extensions, and position indicators.

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
2. Section 15000 Piping Components
3. Section 15101 Valve and Gate Operators

1.3 SPECIFICATIONS AND STANDARDS

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

1.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
3.	ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
4.	ANSI/ASME B31.1	Power Piping
5.	ASTM A 36	Specification for Structural Steel
6.	ASTM A 48	Specification for Gray Iron Castings
7.	ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
8.	ASTM A 536	Specification for Ductile Iron Castings
9.	ASTM B 61	Specification for Steam or Valve Bronze Castings
10.	ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
11.	ASTM B 148	Specification for Aluminum-Bronze Castings

12.	ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications
13.	ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems
14.	ANSI/AWWA C502	Dry-Barrel Fire Hydrants
15.	ANSI/AWWA C503	Wet-Barrel Fire Hydrants
16.	ANSI/AWWA C504	Rubber-Seated Butterfly Valves
17.	ANSI/AWWA C506	Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
18.	ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches
19.	AWWA C508	Swing-Check Valves for Waterworks Service, 2 Inches Through 24 Inches NPS
20.	ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems
21.	AWWA C550	Protective Interior Coatings for Valves and Hydrants
22.	SSPC-SP-2	Hand Tool Cleaning
23.	SSPC-SP-5	White Metal Blast Cleaning

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Manufacturer's product data including catalogue cuts.
2. Manufacturer's installation instructions.
3. Shop drawings showing details and dimensions.
4. Manufacturer's certification that products comply with the indicated requirements.
5. Schedule of valves indicating valve identification and location.
6. Manufacturer's certification that epoxy coatings have been factory tested and comply with the indicated requirements.

1.5 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Manufacturer's installation and operating instructions.
2. Manufacturer's maintenance procedures.
3. List of special tools.
4. Schedule of valves indicating valve identification and location.

1.6 FACTORY TESTING

A. **General**: Valves shall be tested in compliance with the AWWA Standards as indicated. Except as otherwise indicated, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Proof-of-Design Tests**: The DESIGN-BUILDER shall furnish the CONSTRUCTION MANAGER three (3) certified copies of a report from an independent testing laboratory certifying successful completion of proof-of-design testing for all valves of sizes 10-inch and larger unless indicated otherwise in the specific valve Section. In lieu of testing the valves at an independent testing laboratory, proof-of-design testing may be performed at the valve manufacturer's laboratory, but must be witnessed by a representative of a qualified independent testing laboratory representative. Proof-of-design testing shall have been performed on not less than three valves, with all three units demonstrating full compliance with the test standards. Failure to satisfactorily complete the test shall be deemed sufficient evidence to reject all valves of the proposed make or manufacturer's model number.

1.7 FIELD TESTING

A. **Testing**: Valves shall be field-tested for compliance with the indicated requirements.

PART 2 -- PRODUCTS

2.1 VALVES

A. **General:** Shut-off valves, 6-inch and larger, shall have operators with position indicators. Where buried, these valves shall be provided with valve boxes and covers containing position indicators, and valve extensions. Valves mounted higher than 7 feet above working level shall be provided with chain operators.

B. **Valve Flanges:** The flanges of valves shall comply with Section 15000.

C. **Gate Valve Stems:** Where dezincification is indicated, gate valve stems shall be fabricated with bronze conforming to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent of aluminum. Gate valve stems shall be designed for minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems are poured. Where dezincification is not indicated, bronze conforming to ASTM B 584 may be used.

D. **Protective Coating:** Except where otherwise indicated, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4-inch and larger, and exterior surfaces of submerged valves, shall be epoxy coated conforming to Section 09800. Flange faces of valves shall not be epoxy coated.

E. **Valve Operators:** Where indicated, valves shall include electric operators recommended by the manufacturer. Operators of the same type shall be furnished by the same manufacturer. Valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant. Except as otherwise indicated, electric, pneumatic, and hydraulic valve operators shall comply with Section 15101.

F. **Nuts and Bolts:** Nuts and bolts on valve flanges, bodies and supports shall comply with Section 05500.

2.2 NAMEPLATES, TOOLS AND SPARE PARTS

A. **Nameplates:** Except as otherwise indicated, a label shall be provided on all valves exclusive of hose bibbs and chlorine cylinder valves. The label shall be 1/16-inch plastic or stainless steel, minimum 2 inches by 4 inches in size, and shall be permanently attached to the valve.

B. **Spare Parts:** Two sets of packings, O-rings, gaskets, discs, seats, and bushings shall be furnished with each valve, as applicable.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General:** Valves, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's installation instructions. Valves shall be independently supported to prevent stresses on the pipe.

B. **Access:** Valves shall be installed to provide easy access for operation, removal, and maintenance and to prevent interferences between valve operators and structural members or handrails.

C. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are indicated, the combinations shall be properly assembled and installed to ensure that systems are compatible and operating properly.

**** END OF SECTION ****

SECTION 15101 - VALVE AND GATE OPERATORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing all shut off and throttling valves with manual and power operators as indicated. The DESIGN-BUILDER shall provide the valve and gate operators, complete and operable, including all controls, motors, gears, enclosures and other necessary appurtenances as indicated.

B. The WORK also requires that the valve or gate manufacturer accept responsibility for furnishing the WORK in this Section but without altering or modifying the DESIGN-BUILDER'S responsibilities under the Contract Documents.

C. The WORK additionally requires that the one manufacturer who accepts the indicated responsibilities shall manufacture the valve or gate, as a minimum.

D. The WORK also includes coordination of design, assembly, testing and installation.

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 15100 Valves, General
2. Section 16040 Electric Motors
3. Section 16050 Basic Electrical Materials and Methods

1.3 SPECIFICATIONS AND STANDARDS

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

1.	JIC P-1	Pneumatic Standards for Industrial Equipment and General Purpose Machine Tools
2.	NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions in addition to the provisions of Section 15100:

1. Electrical wiring and control diagrams.

1.5 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: If requested by the CONSTRUCTION MANAGER, an authorized representative of the manufacturer shall visit the site for a duration to be determined by the CONSTRUCTION MANAGER.

B. **Instruction of OWNER'S Personnel:** If requested by the CONSTRUCTION MANAGER, the authorized service representative shall also furnish the indicated services for instruction of OWNER'S in accordance with Section 2-5.3.8 of the Supplementary Special Provisions.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General:** Unless otherwise indicated, all shut-off and throttling valves, and externally-actuated valves and gates, shall be provided with manual or power operators. The DESIGN-BUILDER shall furnish all operators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. All operators shall be capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering. All wires of motor-driven operators shall be identified by unique numbers.

B. **Manufacturers:** Where indicated, certain valves and gates may be provided with operators manufactured by the valve or gate Manufacturer. Where operators are furnished by different manufacturers, the DESIGN-BUILDER shall coordinate selection to have the fewest number of manufacturers possible.

C. **Materials:** All operators shall be current models of the best commercial quality materials and liberally-sized for the maximum expected torque. All materials shall be suitable for the environment in which the valve or gate is to be installed.

D. **Mounting:** All operators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and of ample strength. The word "open" shall be cast on each valve or operator with an arrow indicating the direction to open in the counter-clockwise direction. All gear and power operators shall be equipped with position indicators. Where possible, manual operators shall be located between 48 and 60 inches above the floor or a permanent work platform.

E. **Standard:** Unless otherwise indicated and where applicable, all operators shall be in accordance with ANSI/AWWA C 540 - AWWA Standard for Power-Actuating Devices for Valves and Sluice Gates.

F. **Functionality:** Electric, pneumatic, and hydraulic operators shall be coordinated with power and instrumentation equipment indicated elsewhere in the Contract Documents.

2.2 MANUAL OPERATORS

A. **General:** Unless otherwise indicated, all valves and gates shall be furnished with manual operators. Valves in sizes up to and including 3 inches shall have direct acting lever or handwheel operators of the Manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual operators, with an operating pull of maximum 60 pounds on the rim of the handwheel. All buried and submerged gear-assisted valves, all gates, all gear-assisted valves for pressures higher than 250 psi, all valves 30 inches in diameter and larger, and where so indicated, shall have worm-gear operators, hermetically-sealed and grease-packed, where buried or submerged. All other valves 4 inches to 24 inches in diameter may have traveling-nut operators, or worm-gear operators as indicated.

B. **Buried Valves:** Not Used

C. **Chain Operator:** Not Used

D. **Floor Boxes:** Not Used

E. **Adjustable Shaft Valve Boxes:** Not Used

F. **Manual Worm-Gear Operator:** Not Used

G. **Traveling-Nut Operator:** Not Used

2.3 ELECTRIC MOTOR OPERATORS

A. General

1. **Equipment Requirements:** Where electric motor operators are indicated, an electric motor-actuated valve control unit shall be attached to the actuating mechanism housing by means of a flanged motor adaptor piece.

2. **Gearing:** The motor operator shall include the motor, reduction gearing, reversing starter, torque switches, and limit switches in a weather-proof NEMA [4][7][8] assembly. The operator shall be a single or double reduction unit consisting of spur or helical gears and worm-gearing. The spur or helical gears shall be of hardened alloy steel and the worm-gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease- or oil-lubricated in a sealed housing. Ball or roller bearings shall be used throughout. Operator output speed changes shall be mechanically possible by simply removing the motor and changing the exposed or helical gearset ratio without further disassembly of the electric operator.

3. **Starting Device:** Except for modulating valves, the unit shall be so designed that a hammer blow is imparted to the stem nut when opening a closed valve or closing an open valve. The device should allow free movement at the stem nut before imparting the hammer blow. The operator motor must attain full speed before stem load is encountered.

4. **Switches and Wiring:** Travel in the opening and closing directions shall be governed by a switch responsive to mechanical torque developed in seating the valve, or by an obstruction met in opening or closing the valve, or by an on-board microprocessor. The torque switch shall be adjustable and shall function without auxiliary relays or devices, or it shall be adjustable in one-percent increments, sensed by a pulse-counter which receives 15 pulses per rotation of the unit. The geared limit switches shall be of the open type and shall be actuated by a rotor cam with 4 contacts to each cam or gear train. The operator shall have a number of gear trains as required to produce the operation indicated. The operator shall be wired in accordance with the schematic diagram. All wiring for external connections shall be connected to marked terminals. One 1-inch and one 1-1/4-inch conduit connection shall be provided in the enclosing case. A calibration tag shall be mounted near each switch correlating the dial setting to the unit output torque. Position limit switches and associated gearing shall be an integral part of the valve operator. To provide the best possible accuracy and repeatability, limit-switch gearing shall be of the "counting" intermittent type, made of stainless steel, grease-lubricated, and enclosed in its own gearcase to prevent dirt and

foreign matter from entering the gear train. Switches shall not be subject to breakage or slippage due to over-travel. Traveling-nuts, cams, or microswitch tripping mechanisms shall not be used. Limit-switches shall be of the heavy-duty open contact type with rotary wiping action.

5. **Handwheel:** A permanently-attached handwheel shall be provided for emergency manual operation. The handwheel shall not rotate during electrical operation. The maximum torque required on the handwheel under the most adverse conditions shall not exceed 60 lb-ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb. An arrow and either the word "open" or "close" shall be cast or permanently affixed on the handwheel to indicate the appropriate direction to turn the handwheel.

6. **Motor:** The motor shall be of the totally-enclosed, non-ventilated, high-starting torque, low-starting current type for full voltage starting. It shall be suitable for operation on 240-volt, 1-phase or 120-volt, 1-phase, 60-Hz current, and have Class F insulation and a motor frame with all dimensions in accordance with the latest revised NEMA MG Standards. The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 40 degrees C when operating continuously for 15 minutes under full rated load. With a line voltage ranging between 10 percent above to 10 percent below the rated voltage, the motor shall develop full rated torque continuously for 15 minutes without causing the thermal contact protective devices imbedded in the motor windings to trip or the starter overloads to drop-out. All bearings shall be of the ball type and thrust bearings shall be provided where necessary. All bearings shall be provided with suitable seals to confine the lubricant and prevent the entrance of dirt and dust. Motor conduit connections shall be watertight. Motor construction shall incorporate the use of stator and rotor as independent components from the valve operation such that the failure of either item shall not require operator disassembly or gearing replacement. The motor shall be furnished with a space heater suitable for operation on 120-volt, single-phase, 60-Hz circuit unless the entire operator is an hermetically-sealed, non-breathing design with a separately sealed terminal compartment which prevents moisture intrusion.

B. Electric Motor Operators (AC Modulating Control Type)

1. **General:** Where indicated, modulating electric motor operators shall be the ac modulating type complete with a local control station with open/close/auto/hold functions.

2. **Control Module:** The control module shall be of the electronic solid-state ac type with proportional pulse output to control the speed of the motor. Control modules shall be compatible with the existing valve control loop system.

3. **Starter:** The operator shall control a solid-state reversing starter designed for minimum susceptibility to power line surges and spikes. The solid-state starter and control module shall be rated for continuous modulating applications. Power supply shall be 480-volt, 3-phase, 60-Hz.

4. **Construction:** The control unit shall be microprocessor-based and shall contain an analog/digital converter, separate input-output switches, non-volatile random access memory for storage of calibration parameters and push-button calibration elements for field-setup. Potentiometer adjustments shall contain a PID control function internally.

In addition, the controller shall contain as standard feature a loss of command signal protection selectable to lock in last or lock in pre-set valve position and a valve position output signal in 4-20 mA. As an alternative to the construction requirement, the motor shall be capable of modulating at a rate of 200 starts per hour at the 50 percent to 85 percent travel range of the valve.

2.3 PNEUMATIC OPERATORS

Not Used

2.4 FLUID POWER SYSTEMS

Not Used

2.5 MANUFACTURERS

A. Products shall be from the following manufacturers, or equal.

1. AC Modulating Control Type Operators

EIM
Limitorque Corporation
Rotork

PART 3 -- EXECUTION

3.1 GENERAL

Installation shall be as specified herelin. Valve operators shall be located so that they are readity accessible for operation and maintenance. Valve operators shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Valve operators shall not be mounted where shock or vibration will impair their operation. Support systems shall not be attached to handrails, process piping, or mechanical equipment.

A. Field Adjustments

1. Field representatives of manufacturers of valves or gates with pneumatic, hydraulic, or electric operators shall adjust operator controls and limit-switches in the field for the required function.

3.3 INSTALLATION

A. All valve and gate operators and accessories shall be installed in accordance with Section 15100 - Valves, General.

**** 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 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 15100 Valves, General

1.3 FACTORY TESTING

A. Valves shall be tested in compliance with AWWA C507 and Section 15100.

B. Proof-of-design tests shall be submitted in compliance with Section 15100 for all ball valves size 10-inch and larger.

PART 2 -- PRODUCTS

2.1 BALL VALVES (6-INCH AND LARGER)

A. **Construction:** Except as otherwise indicated, ball valves in sizes 6-inches and larger shall comply with ANSI/AWWA C 507, with cast iron, ductile iron, or cast steel bodies, support legs or pads, flanged ends, and shall be designed for velocities up to 35 fps, temperatures up to 125 degrees F, and design pressures of [150 psi] [250 psi] [300 psi]. The balls shall be fabricated with cast iron, ductile iron, or cast steel, and designed for shaft- or trunnion-mounting, with tight shut-off, single or double seat, and full bore. The valves shall be rubber- or metal-seated, with stainless steel or monel shafts, and shall include at least one thrust bearing. Ferrous surfaces of valves 6-inches and larger, where contact with water is indicated, shall be epoxy-coated conforming to Section 09800.

B. **Operators:** Except as otherwise indicated, ball valves shall have manual operators with handwheel, position indicator, and 2-inch square operating nut. Operators for buried valves and for power operated valves shall comply with Section 15101.

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 conforming to Section 09800.

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

A. **General Requirements:** Plastic ball valves designed for use with corrosive fluids shall be fabricated of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), or polyvinylidene fluoride (PVDF), as recommended by the manufacturer for use in the service indicated. Valves shall have manual operators except as otherwise indicated.

B. **Construction:** Plastic ball valves shall have union ends or flanged ends conforming to ANSI B 16.5, class 150. Balls shall have full size ports and Teflon seats. Body seals, union O-ring seals, and stem seals shall be Viton. Valves shall be suitable for a maximum working of 150 psi at 73 degrees F for PVC.

2.4 MANUFACTURERS

A. Ball valves shall be manufactured by the following (or equal):

1. Ball Valves (6-inch and Larger):

Grove Valve and Regulator Company
McNally Pittsburg, Inc.
Henry Pratt Company
Willamette Valve, Inc.

2. Ball Valves (4-inch and Smaller):

Jamesbury Corporation
Jenkins Bros.
Lunkenheimer Flow Control
Wm. Powell Company
Worcester Controls

3. Plastic Ball Valves:

ASAHI-America, (full port: ½ to 4 inches only)
G F Plastic Systems, Inc., (full port: ½ to 2 inches only)
NIBCO Inc., (Chemtrol), (full port: ½ to 4 inches only)
Spears, (full port: ½ to 6 inches only)

PART 3 -- EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with Section 15100.

**** END OF SECTION ****

SECTION 15107 - DIAPHRAGM VALVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing diaphragm valves.

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 15100 Valves, General

PART 2 -- PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

A. **General:** Except as otherwise indicated, diaphragm valves shall be of the weir type, designed for throttling service and operation in any position. Valves manufactured of polyvinyl chloride (PVC) shall have a pressure rating of 150 psi at 73 degrees F and 15 psi at 140 degrees F. Valves manufactured of chlorinated polyvinyl chloride (CPVC) shall have a pressure rating of 150 psi at 73 degrees F and 40 psi at 210 degrees F. Valves shall be designed for bubble-tight shut-off.

2.2 CONSTRUCTION

A. **Body:** Except as otherwise indicated, valve bodies shall be fabricated of PVC or CPVC, conforming to ASTM D 1784, and recommended by the manufacturer for the service indicated, with threaded ends or flanged ends conforming to ANSI B16.5 (150 psi). The valves shall include position indicators.

B. **Diaphragm:** Diaphragms of valves shall be fabricated of chlorosulfonated polyethylene such as Hypalon (or equal), except that the diaphragms for valves in chlorine solutions and chlorine gas lines shall be Teflon.

C. **Operator:** Except as otherwise indicated, valves shall be handwheel-operated. Handwheels shall be made of plastic or material with plastic coating. Where pneumatic or electric operators are indicated they shall be provided by the valve manufacturer, and shall include limit switches, positioners, and accessories.

2.3 MANUFACTURERS

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

ASAHI/AMERICA
Hills-McCanna Company
ITT Engineered Valves
NIBCO, Inc. (Chemtrol)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Diaphragm valves shall be installed in chlorine solution and chemical feed lines, between the storage tanks and points of application, and where indicated.

B. Valves shall be installed in accordance with Section 15100.

**** 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.

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 15100 Valves, General

PART 2 -- PRODUCTS

2.1 BACKFLOW PREVENTER VALVES

Not Used

2.2 SEWAGE SURGE RELIEF VALVES

Not Used

2.3 TEMPERATURE AND PRESSURE RELIEF VALVES

A. **Valve Construction:** Temperature and pressure relief valves for cold and hot water, steam, and air service, unless otherwise indicated, shall have a minimum pressure rating of 250 psi, bronze, steel, or stainless steel bodies, adjustable spring action, screwed or flanged connections, and trim to suit individual applications. They shall be set for each specific condition.

2.4 CORPORATION STOPS

Not Used

2.5 PINCH VALVES

A. Pinch valves shall be of the manually, electrically, pneumatically or hydraulically operated type, as indicated. The valves shall have flanged, split cast iron bodies with ANSI Class 125 lb rating, unless otherwise indicated. The sleeves shall be of the best elastomer recommended for the specific application.

1. Pinch check valves for in-line service shall have split cast iron bodies with ANSI Class 125 lb flanged ends and elastomer sleeves best suited for the application. Check valves for end-of-line service shall be of all elastomer construction with single flanges.

2.6 MANUFACTURERS

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

1. Pinch valves

Red Valve Company, Inc.
RKL (Robbins & Myers)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Backflow preventers shall be installed in potable water lines where required by applicable codes or regulations, or wherever there is any danger of contamination, and where indicated.

B. All valves shall be installed in accordance with the manufacturer's printed recommendations.

C. All backflow preventers shall have piped outlets to the nearest acceptable drain, firmly supported, and installed in such a way as to avoid splashing and wetting of floors.

**** 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 6-8.2.1 and 6-8.2.2 of the Supplementary Special Provisions Equipment Testing and Plant Startup
2. Section 13300 Instrumentation and Control
3. Section 16050 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, Section 16T: Electrical Acceptance Tests

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 the 7-day test indicated in Section 6-8.2.1 and 6-8.2.2 of the Supplementary Special Provisions.

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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: Switching, including remote control. Circuitry in accordance with panel schedules. Lighting fixtures located to minimize obstruction of illumination by mechanical equipment or building structural elements.

2. Power Instrumentation: Demonstration that voltmeter and ammeter switches are functional and that meters, including kilowatt meters, are installed within catalog accuracy.

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. Phase-to-phase A-B, B-C, A-C and phase-to-ground insulation resistance tests shall be performed on each 5 kv, 15 kv, and 25 kv cable prior to termination at equipment but subsequent to stress cone makeup. Test results shall be submitted for review 30 days prior to plant operation and any system testing. Equipment which may be damaged during this test shall be disconnected. Tests shall be performed with other equipment connected to the circuit. The cable must withstand the test high voltage without breakdown, and shall exhibit steady or decreasing leakage current during the high potential test, and have satisfactory comparable megger readings in each megger test. Test results shall identify equipment used and time of test. Cable operating at more than 2,000 volts shall be tested in accordance with ICEA publications S-68-61, S-61-402, S-19-81, and S-68-516. Cable testing and reporting shall be performed by an organization recommended by the Manufacturer of the cable to be tested. The testing organization shall have a record of at least one prior successful project of comparable size and complexity. Testing shall verify the quality of cable terminations. Test results for medium and high voltage cable shall be submitted to the CONSTRUCTION MANAGER 30 days prior to the time schedule for equipment energization.

6. Test ground interrupter (GFI) receptacles and circuit breakers for proper operation by methods recommended by the receptacle Manufacturer.

7. 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.

   Setting of protective relays in conformance with results of the Short Circuit Study and testing of relays to assure that relays will trip at the current value and time required by the Study.

   Circuit breakers which are specified with adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker Manufacturer. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study. Setting shall be tabulated and proven for each circuit breaker in its installed position; test results shall be certified and 7 copies shall be submitted to the CONSTRUCTION MANAGER.

8. 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. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve manufacturer. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.

E. Ground resistance tests shall be conducted in the presence of the CONSTRUCTION MANAGER utilizing ground resistance megger "Earth" tester with a maximum of 0-50 scale. Tests shall be conducted utilizing the full of potential method or the three terminal method as described by Biddle or Neta.

F. 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 during the 7-day test as indicated in Section 6-8.2.1 and 6-8.2.2 of the Supplementary Special Provisions 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 DESIGN-BUILDER.

**** END OF SECTION ****

SECTION 16040 - ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing electric motors with accessories.

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 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. AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings.
2. AFBMA 11 Load Ratings and Fatigue Life for Roller Bearings.
3. ANSI/IEEE 112 Standard Test Procedure for Polyphase Induction Motors and Generators.
4. IEEE 841 Standard for Petroleum and Chemical Industry-Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 500 HP
5. NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies.
6. NEMA ICS 6 Enclosures for Industrial Controls and Systems.
7. NEMA MG 1 Motors and Generators.
8. UL 674 Motors and Generators, Electric, for Use in Hazardous Locations, Class I, Groups C and D, Class II, Groups E, F and G.
9. UL 1004 Motors, Electric

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Machine name and submitted data on driven machine.
2. Motor manufacturer.
3. Motor type, model and dimensioned drawing.
4. Nominal horsepower.
5. NEMA design.
6. Frame size.
7. Enclosure.
8. Winding insulation class and treatment.
9. Rated ambient temperature.
10. Service factor.
11. Voltage, phase, and frequency rating.
12. Full load current at rated horsepower and indicated voltage.
13. Starting code letter, or locked rotor kVA, and current.
14. Special winding configuration.
15. Rated full load speed.
16. Power Factor at full load.
17. Details of water cooling (if any) for thrust bearings.
18. Motor efficiencies.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. **Conformance**: Electric motors driving identical machines shall be identical.

B. **Rating**: The nominal rated motor horsepower shall be adequate for the driven machine without infringing upon the indicated motor service factor, unless more restrictive motor requirements are specified for a specific equipment item.

C. **Minimum Motor hp:** The motor horsepower shall be not less than the minimum indicated for each driven machine. If the minimum horsepower is not adequate, the motor with the next larger horsepower, circuit breakers, magnetic starters, motor feeder conductors and conduit shall be provided.

D. **Exempt Motors:** Except as otherwise indicated, motors intended for valve operators, submersible pumps and hoists, motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven equipment, part of commercial use or domestic equipment and torque-rated motors shall be motors recommended by the manufacturer for use in the application indicated.

2.2 DESIGN REQUIREMENTS

A. **General:** Electric motors shall comply with ANSI/NEMA MG 1.

B. **NEMA Design:** Except as otherwise indicated, electric motors shall be NEMA Design B, constant speed squirrel-cage induction motors designed for normal starting torque with low starting current. In no case shall starting torque or breakdown torque be less than the value indicated in ANSI/NEMA MG 1. Motors shall be suitable for part-winding, star delta starting, or 2 speed winding, where indicated.

C. **Motor Voltage Ratings:** Motors shall be rated in accordance with the following:

1. Motors below 1/2-hp shall be rated 115 volts, single-phase, 60-Hz. Dual voltage motors rated 115/230-volts, 115/208-volts, or 120-240 volts are acceptable.

2. Motors 1/2-hp and larger shall be rated 460 volts, or 4160 volts, 3-phase, 60-Hz. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable.

D. **Explosion-Proof Motors:** Motors which will be installed in Class I or Class II areas (exposed to flammable vapors, gases, or dust) shall be explosion-proof and shall bear Underwriter's approval on name plate and serial number.

E. **Insulation (Standard Duty Motors):** Standard duty motors shall include Class F insulation, rated to operate at an ambient temperature of 40 degrees C without exceeding Class B temperature rise limits at the motor's nominal rating.

F. **Insulation (Heavy Duty Motors):** Heavy duty motors shall include Class F insulation, rated to operate at an ambient temperature of 50 degrees C without exceeding Class B temperature rise limits at the motor's nominal rating

G. **Motors Installed Outdoors:** Motors 50 Hp or smaller which will be installed outdoors shall be totally enclosed, fan cooled (TEFC) with a Service Factor of 1.15.

H. **Motors larger than 50 hp:** Motors larger than 50 hp which will be installed outdoors shall be Weather-Protected Type II. Motors larger than 50 hp shall have a minimum service factor of 1.15 and 2 cycles of solid, baked epoxy vacuum impregnation and shall include rodent screens.

I. **Motors Installed Indoors:** Except as otherwise indicated, all motors which will be installed indoors shall be open drip-proof with a service factor of 1.15 minimum except that motors larger than 50 hp, located in damp environment (pump and pipe galleries, tunnels, chemical feed and sludge areas) shall have 2 cycles of solid baked epoxy vacuum impregnation.

J. **High Efficiency Motors:** Motors with a nameplate rating of 5 hp and above shall be "high efficiency" units with efficiencies determined by the test set forth in ANSI/IEEE 112, Method B with stray load loss adjustment as modified by NEMA MG 1-12.53(a) and (b).

K. **Efficiency Index:** Efficiency index, nominal efficiency, and minimum efficiency shall be defined in accordance with ANSI/NEMA MG 1-12.53.b. Motor nameplate data shall include the nominal efficiency value.

L. **Minimum Motor Full Load Power Factor:** 0.85

M. **High efficiency Motors:** High efficiency motors shall conform to the following minimum efficiency requirements for full load values:

Guaranteed Minimum Efficiency

Motor hp	Synchronous Speed, rpm	(percent) Open	Enclosed
5	3600	86	86
	1800	87	87
	1200	88	88
7-1/2	3600	86	86
	1800	89	89
	1200	88	88
10	3600	89	89
	1800	89	89
	1200	89	89
15	3600	89	89
	1800	90	90
	1200	90	90
20	3600	90	90
	1800	91	91
	1200	90	90
25	3600	90	90
	1800	92	92
	1200	90	90
30	3600	91	91
	1800	92	92
	1200	90	90
40	3600	92	92
	1800	92	92
	1200	92	92
50	3600	91	91
	1800	92	92
	1200	92	92
75	3600	93	93
	1800	94	94
	1200	92	92
100	3600	93	93
	1800	94	94
	1200	93	93
125	3600	94	93
	1800	94	94
	1200	94	94

150	3600	93	93
	1800	95	95
	1200	94	94
200	3600	94	94
	1800	95	95
	1200	94	94
300	3600	95	95
	1800	95	95

N. **Motors for VFD Drives**: Motors for variable frequency drives (VFD) shall be specifically rated for inverter duty and shall be severe duty NEMA MG 1 design A or B, high efficiency, totally enclosed fan cooled (TEFC) with NEMA MG 1 Class F insulation. Winding temperature rise shall be limited to Class B rise when operating over the speed range specified by centrifuge manufacturer with the specified load speed/torque characteristic. Six 100-ohm platinum resistance temperature detectors (RTDs) shall be provided in the stator windings for motors 250 Hp and larger. Motor insulation shall be designed to meet NEMA MG 1, Part 31 (1600-volt peak at a minimum of 0.1 microsecond rise time). Motors shall conform to IEEE 841. All internal surfaces shall be coated with epoxy paint.

Inverter duty motors shall be specifically certified by the motor manufacturer to be compatible with the VFD to be used with the motor. Inverter duty motors shall be designed to operate over the speed or frequency range specified. Inverter duty motors shall be provided with Type 2 thermal protection as specified in NEMA MG 1-12.53.2.

Inverter duty motors shall be equipped with a shaft-grounding unit mounted on the fan housing with stub shaft extended from the motor shaft. Grounding unit shall be equipped with two brushes, totally enclosed and sealed against environmental contamination.

Where specified, or required by the specified application requirements, inverter duty motors shall be totally enclosed, air-over blower-cooled (TEBC). Blowers shall be driven at constant speed by 460-volt, 3-phase, 60 Hz motors. Blower motor shall be TEFC in conformance with paragraph 16040-2.2 G. Blower and ducting shall be an integral part of the main motor frame. Air intake filter shall be provided. Scroll case shall be cast aluminum or iron, and fan wheel shall be Type 304 stainless steel.

O. **Stator Windings and Resistance Temperature Detectors:** Stator windings shall be copper. Except as otherwise indicated, six 100-ohm platinum resistance temperature detectors (RTDs) shall be provided in the stator windings for motors greater than 250 Hp; and one PTC thermister shall be provided on the stator windings for motors from 50 to 250 Hp.

P. **Space Heaters:** 120 volt space heaters shall be provided on all 25 Hp and larger motors.

2.3 MOTOR BEARINGS

A. **General:** Bearings shall comply with Section 11000.

B. **Standard Duty:** Except as otherwise indicated, motors shall be standard duty and shall include bearings with a minimum L-10 life of 50,000 hours.

C. **Heavy Duty:** Where equipment for heavy duty service is indicated, motors shall be heavy duty and shall include bearings designed for a minimum rated L-10 life of 100,000 hours.

D. **Fractional Horsepower:** Fractional horsepower through 2 hp motors shall be furnished with self lubricated ball bearings.

E. **Horizontal Motors Over 2 hp:** Motors larger than 2 hp shall include relubricatable ball bearings except where vertical pump motors are indicated.

F. **Vertical Motors Over 2 hp:** Vertical motors larger than 2 hp shall be furnished with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall comply with the manufacturer's recommendations.

G. **Water-Cooled Motors:** If water cooling is required for the thrust bearings, cooling water lines shall be provided with shut-off valve, strainer, solenoid valve, flow indicator, thermometer and throttling valve.

H. **Temperature Detectors:** Except as otherwise indicated, one RTD per sleeve bearing (or vibration switch for ball bearings) shall be provided for motors greater than 250 Hp.

2.4 ACCESSORY REQUIREMENTS

A. **General:** Horizontal motors 3 hp and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors other than open drip-proof shall include gaskets.

B. **Lifting Devices:** All motors weighing 50 lb or more shall include lifting devices designed for installation and removal.

C. **Terminal Boxes:** Motors rated at 4160-volts shall have extra large terminal boxes to accommodate stress cone terminations as recommended by cable manufacturers.

D. **Space Heaters:** Except as otherwise indicated, all motors 25 hp and larger shall be furnished with space heaters. Space heater rating shall be 120 volts, single-phase, unless otherwise indicated.

E. **Nameplate:** Motors shall include a permanent, non-corrosive nameplate indelibly stamped or engraved with NEMA Standard motor data, including bearing description and lubrication instructions, insulation class, ambient temperature, and power factor at full load.

2.5 MANUFACTURER

A. Motors shall be manufactured by the following (or equal):

General Electric Company
Louis Allis (Division of Magnatek, Inc.)
U.S. Motors Corporation
Westinghouse Electric Corporation

B. Inverter duty motors shall be manufactured by the following (or equal):

Baldor, Inverter Motor
Reliance, RPM-XT
U.S. Motors, Inverter Grade

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Motors shall be installed in accordance with the manufacturer's installation instructions and written requirements of the manufacturer of the driven equipment.

**** 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. Lighting and Power Distribution Panelboards
6. Disconnect Switches
7. Electrical Identification
8. Time Clocks
9. Cabinets and Enclosures
10. Electroliers

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 09800 Protective Coating
3. Section 13300 Instrumentation and Control
4. Section 15034 Gauges
5. Section 16030 Electrical Tests
6. Section 16170 Grounding System

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the DESIGN- 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
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 B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys
ANSI C80.1	Rigid Steel Conduit, Zinc Coated, Specification For
ANSI Z55.1	Gray Finishes for Industrial Apparatus and Equipment
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ANSI/IEEE 386	Separable Insulated Connector Systems for Power Distribution Systems Above 600V
ANSI/IEEE C37.30A	Definitions and Requirements for High- Voltage Air Switches, Insulators, and Supports, Supplement to C37.30-1971
ANSI C37.32	Schedules of Preferred Ratings, Manufacturing Specifications and Application Guide for High-Voltage Air Switches, Bus Supports, and Switch Accessories
ANSI C37.46	Specifications for Power Fuses and Fused Disconnecting Switches
NEMA VE-1	Ventilated Cable Tray
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
IPCEA S-61-402	Thermoplastic - Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

IPCEA S-19	Rubber - Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
JIC EMP-1-67	Electrical Standards for Mass Production Equipment
AEIC CS6	Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 KV
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
ASTM A193/A193M	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
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 1242	Intermediate Metal Conduit
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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

General

Shop drawings including the following:

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.

Lighting and Power Distribution Panelboards

Manufacturer's data as follows:

Manufacturer's certification that bus bracing is capable of withstanding the specified short circuit condition.

Quantity and rating of circuit breakers provided with each panelboard.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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**: 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. **Outdoor Locations**: In outdoor locations, raceway shall be rigid galvanized steel conduit; entrances shall be threaded; and fittings shall have gasketed covers. Fittings and conduit shall be drained. Threaded fastening hardware shall be stainless steel. Mounting brackets shall be galvanized. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets, panels, switchboards and motor control centers shall be "Weatherproof NEMA Type 3R." Enclosures shall be mounted 1/4-inch from walls to provide an air space unless specifically shown otherwise.

D. **Damp Location**: 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.

E. **Splash Locations**: Areas indicated as "splash-proof" locations shall have electrical installations as described for "outdoor locations"; except, that NEMA Type 4 enclosures shall be provided for instruments and controls, panels, switchboards, and motor control centers.

F. **Corrosive Locations**: Areas indicated as "corrosive" 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 equal. Corrosive locations include chemical feeder and chemical storage rooms, chlorination rooms, reservoir access, valve structures, and outdoor areas within 10 feet of chemical storage tanks and areas within 10 feet of inlet channels.

G. **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), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). 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: Raceway shall be rigid steel conduit complying with ANSI C80.1 unless otherwise indicated. Rigid steel conduit shall be full weight, mild steel, hot-dip galvanized and bichromate coated inside and outside after galvanizing.

2. Intermediate Metal Conduit: Intermediate metal conduit shall comply with UL 1242 and FEDSPEC WW-C-581E and shall have smooth finished surfaces. Conduit shall be galvanized. Minimum size shall be 3/4 inch.

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 ¾-inch movement in any direction.

4. Plastic Coated Rigid Steel Conduit and Fittings: Plastic coated conduit 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: Electrical metallic tubing shall be electrogalvanized complying with ANSI C80.3. Fittings shall be compression type. Minimum size shall be 3/4 inch. Electrical metallic tubing shall be galvanized inside and out with an enamel coating inside and a chromate coating outside.

6. Flexible Metal Conduit: Flexible metal conduit shall be formed from spirally wound galvanized steel strip with successive convolutions securely interlocked. Minimum size shall be 3/4 inch. Fittings shall be compression type. Flexible metal conduit shall be provided with ground wire.

7. Liquidtight Flexible Steel Conduit: Liquidtight flexible steel conduit shall be formed from spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover. Minimum size shall be 3/4 inch. Fittings for liquidtight conduit shall have cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit, box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.

8. Explosionproof Flexible Conduit: Explosionproof 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: Rigid nonmetallic conduit shall be NEMA TC2, type EPC-40-PVC, or 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 1 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: Cable trays shall be of 14-gauge minimum sheet steel construction with smooth finished surfaces. Trays shall be hot-dip galvanized after fabrication. Cable trays shall comply with NEMA VE1.

    Trays, 12 inches wide or less, shall be Class I; wider trays shall be Class II.

    Unless otherwise indicated, trays shall be ladder type with rungs and side rails. Interior depth shall be [3] inches minimum. Exterior height shall be [4] inches maximum. Tray width shall comply with the indicated requirements and trays shall have maximum rung spacing of [6] inches between centers.

    Where indicated, solid bottom type trays shall have an interior depth of [3] inches minimum. Exterior height shall be [4] inches maximum. Tray width shall be as indicated.

    Cable tray components shall be fabricated to a 1/16-inch tolerance. Bottom to side rail connections shall be positive mechanical joints designed to assure lateral and longitudinal stability.

    Fittings, barriers and covers shall be of the same materials, finish and construction as the straight trays. The minimum radius of side rails on horizontal elbows, vertical risers, tees and crosses shall be [9] inches except where otherwise indicated.

    The trays shall be designed and constructed to support a uniformly distributed load o 50 pounds per linear foot with a maximum deflection of 0.57 inch when tested as a single 10-foot span, simple beam.

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. Explosionproof 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: Hot-dip galvanized framing channel shall be used to support groups of conduit. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps used with galvanized clamp backs and nesting backs where required. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated clamps or PVC conduit wall hangers.

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 corrosive areas and those exposed to weather or moisture shall be stainless steel.

3. Structural Attachments (Racks): Structural attachments shall be constructed from hot-dip galvanized framing channel as specified. Field cuts shall be treated with zinc enriched paint.

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. Housekeeping pads shall be 4 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 traffic 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:

	120/208V	480/277V
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 ¾-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: Multiconductor cable shall be used for power and control circuits installed in cable tray. Cables shall be UL labeled, Type TC, designed for cable tray installation in accordance with NEC 340. The type of insulation, number of conductors, and size of conductor shall comply with the indicated requirements.

   Multiconductor power cable shall contain three or four conductors, as indicated, plus an equipment grounding conductor.

   Multiconductor power cables shall comply with the following:

Voltage:	600 volts.
Conductors:	Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
Insulation:	THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.
Jacket:	Polyvinylchloride (PVC).
Flame resistance:	IEEE 383.

   Unless otherwise indicated, multi-conductor control cable shall be size 14 AWG and shall comply with the following:

Voltage:	600 volts.
Conductors:	Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
Insulation:	THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.

Jacket: Polyvinylchloride (PVC).

Flame resistance: IEEE 383.

E. **Direct Burial:** Direct burial cable shall be multiconductor type MC cable. Cable shall be suitable for direct burial or encasement in concrete, normal or Class 1, Division 2 atmospheres. Cable shall comply with the following:

1. Voltage: 600 volts

2. Conductor: Conductor(s) shall be bare annealed stranded copper. Size and number of conductors shall be as specified on the circuit schedule.

3. Insulation: Insulation shall be Type XHHW, meeting NEMA WC-7 and UL 44.

4. Assembly: The individual conductors shall be cabled together with nonhygroscopic fillers and a binder tape overall. An impervious, continuous, corrugated aluminum sheath shall be welded over the cable core with a black flame-retardant PVC jacket of not less than 50 mils extruded over the armor. Nonwelded type sheath is not acceptable. The armor shall meet the grounding conductor requirements of Table 250-95 of the NEC and UL requirements.

F. **Medium Voltage Power Conductors and Cable (5 KV-15 KV):** Conductors and cable shall comply with the following:

1. Conductors Used In Raceway: The medium voltage power cable shall be suitable for use in raceways except cable trays. Conductors size 250 MCM and larger may be installed in cable trays when permitted by NEC. The cable shall comply with the requirements of ICEA S-68-516, AEIC CS6, UL 1072 and the following:

Voltage: 5 kV or 15 kV as specified.

Conductor: Single conductor, uncoated copper, Class B, stranded as per ASTM B8.

Strand shield: Extruded semiconducting stress relief layer.

Insulation: Ethylene propylene (EPR), Type MV-90, rated continuous 90 degrees C, emergency 130 degrees C, short circuit 250 degrees C, wall thickness rated for 100 percent insulation level.

Insulation screen: Extruded semiconducting stress relief layer.

Shield: Coated copper tape with 12.5 percent overlap.

Jacket: Polyvinylchloride (PVC).

2. Conductors Used In Cable Tray Or Direct Burial (Armored Cable): The medium voltage power cable shall be UL listed for use in cable trays. The cable shall comply with the requirements of ICEA S-68-516, UL 1072 and the following:

Voltage:	5 KV or 15KV as specified.
Conductor:	Uncoated copper, Class B, stranded as per ASTM B8.
Strand screen:	Extruded semiconducting stress relief layer.
Insulation:	Ethylene propylene rubber (EPR), rated MV or MC, rated continuous 90 degrees C, emergency 130 degrees C, short circuit 250 degrees C, wall thickness rated for 100 percent insulation level.
Insulation screen:	Extruded semiconducting stress relief layer.
Shield:	Copper tape.
Jacket:	Chlorosulfonated polyethylene (CSPE) or chlorinated polyethylene (CPE).
Grounding conductor:	Bare copper, Class B, stranded per ASTM B8, and sized in accordance with UL 1072.
Armor interlock:	Aluminum interlocked armor overall.
Overall jacket:	PVC jacket over the armor.
Flame resistance:	IEEE 383, 210,000 Btu/hr.

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: Cable shall consist of four or more pairs or triads which are made up of No. 18 AWG conductors with 15 mils of 90 degree C PVC insulation, 4 mils nylon jacket, twisted on a staggered lay 1-1/2 to 2-1/2 inches, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 22 AWG 7-strand tinned copper drain wire. Overall cable shield shall be 2.35 mil aluminum-Mylar tape with a No. 20 AWG 7-strand tinned copper drain wire. Cable shall be UL listed, Type TC, 600 volts.

4. Thermocouple Extension: Extension cable shall be provided for the type of thermocouple circuit indicated. Conductors shall be 16 AWG, solid alloy, with 15 mils of 90 degree C flame-retardant polyvinylchloride insulation, twisted and covered with 100 percent 2.35 mil aluminum polyester tape and a 20 AWG, 7-strand, tinned-copper drain wire and a 35 mil, flame-retardant PVC jacket overall. Cable shall be listed for cable tray installation.

5. Communication, Paging and Security System: Communication, paging, and security system cables shall comply with Section 13300.

H. **Portable Cord:** Portable cord shall be UL listed, Type SO for sizes No. 10 AWG and smaller. Cords with conductors larger than No. 10 AWG shall be UL listed, Type G. Cords shall contain an equipment grounding conductor.

1. Cables shall comply with the following:

Conductors:Flexible rope stranded per ASTM B189 and B33. Conductors shall be coated except ground conductors may be uncoated.

Insulation: Insulation shall be ethylenepropylene (EPR) as per ICEA S-68-516 and rated for continuous operation at 90 degrees C.

Jacket: Heavy-duty neoprene as per ICEA S-68-516.

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: Terminations shall be made with a tin-plated compression type lug and a compression pressure tool recommended by the manufacturer of the lug. Tool shall be of the hydraulic pump type or the type that crimps to the required size before releasing. Electrical voltage stresses shall be controlled by high permitivity, high resistivity, heat shrinkable polymeric tubing. Termination shall be sealed using heat shrinkable tubing and heat activated adhesive. Corona extinction level for a completed termination on a cable shall not be less than 1-1/2 times the rated cable phase to ground voltage.

Splices shall be made with a tin-plated copper compression connector and a compression tool as recommended by the manufacturer of the connector. Tool shall be of the hydraulic pump type or the type that crimps to the required size before releasing. Electrical voltage stresses shall be controlled by utilization of high permitivity, high resistivity, heat shrinkable polymeric tubing. The splice shall be sealed with a heat activated adhesive and an outer heat shrinkable jacket tubing. Splice shall provide continuity of the cable shield using a wire mesh and grounding clamps.

Load break connectors and bushings shall be rated 8.3 KV phase to ground and 14.4 KV phase to phase across contact; 95 KV BIL; 35 KV, 60 Hz, 1 minute; 11 KV corona extinction; 200 amp continuous, 300 amps, 8 hours; 15,000 amps RMS (asym), 12 cycles, 10,000 amps RMS (sym), 30 cycles; and shall comply with the requirements of ANSI C119.2. Connectors and bushings shall include items necessary for a complete installation.

Nonload-break connectors and bushings shall be rated 8.3 KV phase to ground and 14.4 KV phase to phase; 95 KV BIL; 35 KV, 60 Hz, 1 minute; 11 KV corona extinction; 600 amps continuous; 900 amps, 8 hours; 40,000 amps RMS (asym), 12 cycles; 27,000 amps RMS (sym), 4 seconds; and shall comply with the requirements of ANSI C119.2. Connectors and bushings shall include items necessary for a complete installation.

3. Portable Cable Fittings: Portable cable fittings for terminating the cable shall provide a watertight seal between the cord and the terminator and between the terminator and mounting hub. The cable terminator shall include neoprene liner which grips the cord jacket when the back nut on the fitting is tightened.

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:** Receptacles and plugs shall comply with the following:

1. General: Receptacles shall be grounding type.

2. 120V Receptacles: Receptacles indicated for indoor use in clean areas shall be duplex 20 amp, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps.

   Receptacle indicated for use outdoors or in process or corrosive areas shall be duplex, 20 ampere, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps. Receptacle and plug caps shall be GFCI rated, corrosion resistant, marine duty with yellow polycarbonate weatherproof lift covers.

3. Ground Fault Interrupter Receptacles: Receptacles shall be NEMA 5-20R configured and shall mount in a standard outlet box. Units shall trip at 5 milliamperes of ground current and shall comply with NEMA WD-1-1.10 and UL 943. GFI receptacles shall be capable of individual as well as "downstream" operation.

4. 240V Receptacles: 240-volt duplex receptacles shall be 2-pole, 3-wire, grounding type, 240-volt, ac, 20-amperes, NEMA Configuration 6-20R.

Single 30-ampere receptacles shall be 2-pole, 3-wire, grounding type, 125-volt, ac, 30-amperes, NEMA Configuration 5-30R.

5. Plug Caps: Male plug caps for 120 volt and 240 volt receptacles shall be of the cord grip armored type with heavy phenolic housing, of the same manufacture as the receptacle. Plug caps shall be rated 15 amps. One plug cap shall be provided for every four receptacles.

6. Three Phase Receptacles and Plugs: Receptacles shall be suitable for 480 volt, 3-phase, 4-wire service, with ampere ratings as indicated. Receptacles and plugs shall be designed so that the grounding pole is permanently connected to the housing. The grounding pole shall make contact before the line poles are engaged when the plug is connected to the receptacle housing. The plug sleeve shall also make contact with the receptacle housing before the line and load poles make contact. Receptacles shall include cast back box, angle adapter, gaskets, and a gasketed screw-type, weathertight cap with chain fastener. Each receptacle shall be provided with one plug.

7. Receptacles For Hazardous Areas: Receptacles for use in hazardous areas shall be rated in accordance with NEC for the area in which they are to be located and shall be factory sealed. Receptacles shall be designed so the plug must be inserted and turned before load is energized. Receptacles shall be provided with mounting box, sealing chamber, and compatible plug.

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 20 amp press switch type with weatherproof/ corrosion resistant neoprene plate.

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:** Plug strips shall be manufactured of sheet steel with the receptacles mounted on the front cover. The front cover shall be removable.

Plug strips for office and laboratory areas shall have single 3 wire, 20 ampere grounding type receptacles mounted along the strip on a single circuit.

Plug strips for work benches in shop and laboratory areas shall have 3 wire, 20 ampere grounding type duplex receptacles mounted along the strip on the circuits indicated. Sufficient space shall be provided behind the receptacles for ten No. 12 AWG conductors in accordance with the NEC space rules.

2.6 LIGHTING AND POWER DISTRIBUTION PANELBOARDS

A. **General:** Panelboards shall be flush, surface or motor control center mounted as indicated. Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1 and UL circuit breakers shall be group mounted. Panelboards used for service equipment shall be UL labeled for such use.

Ground fault circuit breakers shall be provided for circuits which supply convenience outlets located outdoors or within lavatory and wash down areas indoors.

Handle lock-off devices for circuit breakers which act as motor disconnect switches shall be provided as indicated in panel schedules.

Trim and cabinets of surface-mounted panels in general purpose areas shall be phosphate treated, primed and finished with baked enamel, panels of flush mounted panels shall be finished to match surrounding wall color. Surface mounted cabinets and trim in wet and damp areas shall be galvanized. Panelboards in corrosive areas shall be encased in fiberglass enclosures.

The number of circuit breakers and the ampere ratings for lighting panelboard shall be in accordance with panel schedules indicated. The panelboard circuit breakers shall be group mounted and shall be Type NQOB with 3- or 2-pole main breakers as required and branch circuit breakers with 10,000 AIC, minimum or as indicated.

Panelboards shall comply with the following:

1. Arrangement and Construction: The front of the panel shall have concealed trim clamps and hinges. The locks shall be flush with cylinder tumbler-type with spring loaded door pulls. The fronts shall not be removable with doors in the locked position. Panelboard locks shall be keyed alike.

   Gutter space shall be provided on all sides of the breaker assembly to connect and arrange incoming wiring.

   A directory holder with clear plastic plate and metal frame shall be mounted on the inside of the door.

2. Bus: Bus shall be tin-plated copper and shall have current ratings indicated on the panelboard schedules and shall be sized in accordance with UL 67. Ratings shall be determined by temperature rise test. Minimum bus size shall be 100 amperes. Panel fault withstand rating shall be equal to the interrupting rating of the smallest circuit breaker in the panel.

   Panelboards shall include a separate ground bus.

   Neutral bar shall be full-sized and shall have one terminal screw for each branch circuit; main bus bar shall be full-sized for entire length.

   The neutral bus of instrument power panels shall be mounted on insulated stand-offs.

   Spaces shown shall have cross connections for the maximum sized device that can be fitted.

3. Circuit Breakers: Circuit breakers for power panelboard shall be molded-case type designed for the current ratings and pole configurations indicated on the panelboard schedule. Circuit breakers rated 120/208 volt and 120/240 volt alternating current shall have a minimum interrupting current rating of 18,000 amperes (symmetrical) at 240V AC. Circuit breakers rated 277/480 volt alternating current shall have a minimum interrupting current rating of 25,000 amperes (symmetrical) at 480V AC or as indicated on the panelboard schedule.

   Circuit breakers shall be bolt-on type and shall be listed in accordance with UL 489 for the service indicated.

4. Finish: Panelboard cabinet shall be fabricated from hot-dip galvanized steel in accordance with UL 50. Panelboard fronts shall have a gray, baked enamel finish.

B. **Lighting Panelboards**: Except as otherwise indicated, lighting panelboards shall be rated for 120/208-volt 3-phase operation or 120/240-volt for single phase operation. Cabinets for building panels shall be 20-inch wide minimum, with 4-inch minimum side gutters and 5-inch minimum top and bottom gutters. Panelboard trim shall be the same size as cabinet on surface-mounted panels and 3/4-inch larger all around than cabinet of flush-mounted panels.

C. **Power Panelboards:** Power panelboards shall be rated for 600 volts, 3-phase operation. Cabinets for power panelboards shall comply with the following: with 225-amp mains, 30 inches wide; with 400-amp, 38 inches wide; with 1200-amp mains, 42 inches wide. Minimum bottom and top gutters shall be 8-inch, minimum side gutter shall be 5-inch.

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 unless otherwise specified.

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 TIME CLOCKS

A. Time clocks shall be commercial electric sealed synchronous motor type, 12-inch round dial with white face and black arabic numerals, and shall be suitable with one minute sub-divisions, a red sweep second hand, black hour and minute hands, a manual reset knob, and a recessed back box with three-pole receptacle.

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

A. Electroliers shall comply with the requirements of SSPWC Subsection 209-2.

2.12 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:
   Okoguard-Okoseal, Series 114-23-3XXX 5 kVall5-23-2XXX 15kV
   Anaconda
   Uniblend EP

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. Toggle Switches:

Hubbell	**Bryant Hubbell**	**Bryant**		
Single Pole	1221 (brown)	4901 (brown)	1221I (ivory)	4901I (ivory)
Three Way	1223	4903	1223I	4903I
Double Pole	1222	4902	1222I	4902I
Momentary	1556	4821	1556I	4821I

24. Switches (Hazardous Areas):
    Crouse-Hinds EFSC2129
    Appleton EFSC175-F1

25. Electrical Identification:
    Nameplates
    Formica Type ES-1

    Imprinted Plastic Coated Cloth
    Brady
    Thomas & Betts

26. Device Plates:
    Crouse-Hinds
    Appleton

27. Plug Strips:
    Plugmold

28. Manholes and Pullboxes:
    Brooks
    Quikset

29. Flexible Conduit:
    American Brass
    Anaconda
    Electroflex

30. Cable Trays:
    P-W
    Cope

31. Compression Connectors:
    Burndt "Hi Lug"
    Thomas & Betts "Shure Stake"

32. Spring Connectors (Wire Nuts):
    3M "Scotch Lok"
    Ideal "Wing Nuts"

33. Insulating Tape:
    Scotch No. 33
    Plymouth "Slip knot"

34. High Temperature Insulating Tape (Polyvinyl):
    Plymouth
    3M

35. Pre-Insulated Fork Tongue Lugs:
    Thomas & Betts RC Series
    Burndy

36. Epoxy Resin Splicing Kits:
    3M Scotchcoat 82 Series
    Burndy "Hy Seal"

37. Stress Cone Material For Make-up Of Medium Voltage Shielded Cable:
    G & W
    3M
    duPont

38. Stainless Steel Covers:
    Sierra S-line
    Hubbell

39. 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

40. Cast Boxes Required for Pull or Junction Boxes:
    Floor boxes with checker plate covers
    O-Z Type "YR",

    Surface boxes
    O-Z type "YH"

41. Floor Type Outlet Boxes:
    Hubbell Catalog B-2530 with S-2530 cover plate
    Steel City (Russell & Stoll) Catalog 78AL and 889

42. Power Outlet Boxes:
    Hubbell Cat. No. SC-3098
    Steel City Cat. No SFH40RG

43. Telephone Outlet Boxes:
    Hubbell Cat. No. SS-309-T
    Steel City Cat. No SFL10

44. Insulated Bushings:
    O-Z Type A and B
    Thomas & Betts
    Steel City
    Appleton
    Efcor
    Gedney

45. Insulated Grounding Bushings:
    O-Z Type BL
    Thomas & Betts
    Steel City
    Efcor
    Gedney

46. Erickson Couplings:
    Appleton Type EC
    Thomas & Betts
    Steel City
    Efcor
    Gedney

47. Liquid-tight Fittings:
    Appleton Type ST
    Thomas & Betts
    Crouse-Hinds
    Efcor
    Gedney

48. Hubs:
    Appleton Type HUB
    Thomas & Betts
    Myers Scrutite

Efcor

49. Sealing Fittings:
    Appleton Type EYS
    O-Z Type FSK

50. Expansion Couplings:
    O-Z Type D
    Crouse-Hinds Type

51. Induction Relay (Series 1 Control)
    C.F. Warrick
    B.W. Controller

52. Clocks:
    Simplex Time Recorder Co. Type 78-45
    Edwards Co. Cat. 1882B

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 DESIGN-BUILDER 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 conduit. Bends in larger sizes of metallic conduit shall be accomplished by field bending or by the use of factory elbows.

Conduit may be cast integral with horizontal and vertical concrete slabs, providing one-inch clearance is maintained between conduit surface and concrete surface. If said clearance cannot be maintained, the conduit shall be installed exposed below elevated slabs; provided, that in the case of slabs on grade, conduit shall be installed below the slab and shall be encased with a minimum cover of 3 inches of concrete.

Non-metallic conduit may be cast integral with horizontal slabs with placement criteria as stated in the previous paragraph. Non-metallic conduit may be run beneath structures or slabs on grade, without concrete encasement. 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. The use of direct burial thin wall duct will be permitted only as indicated for underground ducts.

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: Galvanized rigid steel shall be installed in the locations indicated:

Embedded or encased in non-hazardous areas	Schedule 40 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 metallic tubing
Final raceway connections to lighting fixtures, equipment and pressure switches subject to vibration-DRY AREAS	Flexible metallic
Final raceway connections to equipment	Liquidtight, flexible 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 DESIGN-BUILDER 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. Coating system shall comply with Section 09900.

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 calk 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:** Unless otherwise indicated, cable trays shall be supported at intervals not exceeding 5 feet. Corners shall be supported by two supports installed as close as possible to the corner, with one support on each side of the corner. Field cuts shall be painted with zinc-rich paint.

Expansion-joint splice plates shall be used to allow 1 1/2-inch free movement between adjacent trays when crossing a building expansion joint.

A minimum clearance of 3/4 inch shall be maintained between trays and concrete surfaces. A minimum spacing of 12 inches shall be maintained between trays, measured from the top of the upper tray to the top of the lower tray. The top of the tray shall be not less than 9 inches from the ceiling.

Solid or louvered type covers shall be provided on signal trays.

Each tray shall be installed with No. 2/0 AWG minimum bare copper equipment ground conductor unless otherwise specified. Ground conductor shall be attached to the outside of each tray section using a bolted bronze or brass ground clamp.

Power cables shall not be placed in cable trays more than two layers deep. Cables shall be arranged in trays so as to provide a minimum of cable cross-overs.

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. Soapstone, talc or UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. 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. **5 KV and 15 KV 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 CO_2-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**: Portable cord feeding permanent equipment, such as pendant cords, pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless steel wire to take the tension from the cable termination. Connection of portable cords to permanent wiring shall be accomplished with the use of terminals. In-line taps and splices shall be used only where indicated.

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: Cables rated 5 kV and above shall be tested using the DC high potential test method and the following:

   DC High Potential Testing: After insulation resistance testing is completed, a DC high potential test shall be performed on cables. The procedure for DC high potential testing shall be in accordance with Section 16030 as modified below.

   The test voltage shall be direct current at 80 percent of final factory DC test voltage or approximately 50 percent of the basic impulse level (BIL) voltage. The test voltage shall not exceed the maximum voltages specified as follows:

   Test voltage, kV

Rated circuit voltage phase-to-phase volts	Conductor size, AWG or KCMIL	100 percent insulation level	133 percent insulation level
2001-5000	8-1000	25	25
5001-8000	6-1000	35	35
8001-15000	2-1000	55	65

   Test results shall demonstrate that the leakage current decreases or remains constant after reaching the specified test voltage.

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 metalorcast ferrous alloy. Ceiling boxes for flush-mounting in concrete shall be welded sheet steel boxes.

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 metalorcast ferrous alloy 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. Outdoors 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

A. **General:** The circuit description as indicated on the record drawings or panelboard schedule shall be typed on the circuit directory.

B. **Testing:** Panelboards shall be tested for proper operation and function.

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.

Enclosures larger in volume than 500 cubic inches shall comply with Section 09800.

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.

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 16170 - GROUNDING SYSTEM

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing grounding for electrical systems, exposed nonenergized metal surfaces of equipment and metal structures.

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 Concrete
2. Section 05500 Miscellaneous Metalwork
3. 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. IEEE 81 Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, Guide for

2. UL 467 Standard for Grounding and Bonding Equipment

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Shop drawings showing details of grounding system.
2. Product data for grounding electrodes and connections.

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Manufacturer's instructions including instructions for storage, handing, protection, examination, preparation and installation of exothermic welded connectors.

2. Test reports indicating overall resistance to ground and resistance of each electrode.

1.7 PROJECT RECORD DRAWINGS

A. The following shall be included in the PROJECT RECORD DRAWINGS in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

1. Accurate record of actual locations of grounding electrodes.

1.8 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. The WORK of this Section includes the following:

1. Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

2. Except as otherwise indicated, grounding products and systems shall comply with the NEC.

2.2 ROD ELECTRODE

A. Rod electrodes shall be 3/4inch copper-clad steel, sectional type, joined by threaded copper alloy couplings. Length of rods forming an individual ground array shall be equal in length and shall be of the length required to obtain a minimum ground resistance of 5 ohms. Top of ground rod shall be fitted with a coupling and steel driving stud. Rods shall be of sufficient length to ensure contact with ground water and shall be not less than 10 feet.

B. Ground cable shall be annealed bare copper, concentric stranded wire. If cable sizes are not indicated, the minimum sizes shall be as follows:

1.	5 and 15 kV switchgear	4/0 AWG
2.	5 kV motor starters	4/0 AWG
3.	15 kV-5 kV transformers	4/0 AWG
4.	5 kV-480V transformers	4/0 AWG
5.	480V switchgear	4/0 AWG
6.	480V MCC and switchboards	2/0 AWG
7.	Cable tray	2/0 AWG
8.	Lighting panels	2 AWG
9.	Exposed metal	2 AWG

2.4 MECHANICAL CONNECTORS

A. Compression connectors shall comply with the following:

1. Material: BronzeCast Copper

2.5 GROUNDING WELL COMPONENTS

A. Grounding well components shall comply with the following:

1. Well Pipe: 8 inch diameter by 24 inch long clay tileconcrete pipe with belled end.
2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.6 MANUFACTURERS

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

1. Rods and Fittings:

Copperweld
Blackburn
Weaver

2. Compression Connectors:

Thomas and Bett

PART 3 -- EXECUTION

3.1 GENERAL

A. Embedded and buried ground connections shall be made by compression connectors utilizing diamond or hexagon dies and a hand compression tool for wire sizes 2 AWG and smaller and a hydraulic pump and compression head for wire sizes 2/0 AWG and larger. Compression connections shall be prepared in accordance with the manufacturer's instructions. Exposed ground connections to equipment shall be made by bolted clamps unless otherwise indicated. Solder shall not be used in any part of the ground circuits.

B. Embedded ground cables and fittings shall be securely attached to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement. As each part of the grounding system which is laid below finished grade is completed, the CONSTRUCTION MANAGER shall be notified 2 hours prior to backfilling.

C. Grounding conductors which are extended beyond concrete surfaces for equipment connection shall be extended a sufficient length to reach the final connection point without splicing. Minimum extension shall be 3 feet. Grounding conductors which project from a concrete surface shall be located as close as possible to a corner of the equipment pad, protected by conduit, or terminated in a flush grounding plate. Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals maximum grounding conductors for future equipment shall be terminated using a two-hole copper flush mounted grounding plate.

D. Grounding conductor shall not be used as a system neutral.

E. Lightning arresters shall be directly connected to the ground system using copper conductors.

3.2 FACILITY GROUNDING

A. Ground continuity throughout the facility shall be maintained by installing an electrically-continuous metallic raceway system.

B. Metallic raceway shall be installed with double lock nuts or hubs at enclosures. Metallic conduits shall be assembled to provide a continuous ground path. Metallic conduits shall be bonded using insulated grounding bushings and shall be connected to the grounding system. Cable trays shall have No. 2/0 AWG bare copper ground conductor run on the outside of each tray. Conductor shall be connected to each section or fitting using a carriage bolt and clamp.

3.3 EQUIPMENT AND ENCLOSURE GROUND

A. Electrical and distribution equipment and metal equipment platforms which support any electrical equipment shall be bonded to the nearest ground bus or to the nearest switchgear ground bus. This grounding requirement is in addition to the indicated raceway grounding.

B. Connection to ground electrodes and ground conductors shall be exothermic welded where concealed and shall be bolted pressure type where exposed. Bolted connectors shall be assembled wrench-tight.

C. Insulated grounding bushings shall be employed for all grounding connections to steel conduits in switchboards, in motor control centers, in pullboxes, and elsewhere where conduits do not terminate at a hub or a sheet metal enclosure.

D. Where insulated bushings are required, they shall be installed in addition to double lock-nuts.

E. Shielded power cable shall have its shield grounded at each termination in a manner recommended by the cable manufacturer. Shielded instrumentation cable shall be grounded at one end only; this shall be at the Motor Control Board or otherwise at the "receiving" end of the signal carried by the cable except as otherwise indicated. Termination of each shield drain wire shall be on its own terminal screw. All of these terminal screws in one rack shall be connected with No. 16 solid tinned bare copper wire jumper; connection to ground shall be accomplished with a No. 12 green insulated conductor to the main ground bus.

F. Nonelectrical equipment with metallic enclosures shall be connected to the grounding system.

3.4 ISOLATED GROUNDING

A. Where the manufacturer of equipment supplied from 120 volt instrument power panels requires an isolated ground, an additional isolated ground conductor from the equipment through the instrument power panel for connection to a single point ground bus in the automatic transfer switch enclosure shall be provided. The isolated ground conductor shall have green insulation with a yellow stripe and shall be run in the same raceway as the power and neutral conductors.

B. The neutral conductor from the ultra-isolation transformers shall be grounded only at the single point ground bus in the automatic transfer switch.

3.5 EXAMINATION

A. The WORK of this Section includes verification that final backfill and compaction has been completed before driving rod electrodes.

3.6 INSTALLATION

A. Rod electrodes shall be installed at locations indicated.

B. Grounding well pipes with cover shall be installed at each rod location with well pipe top flush with finished grade.

C. Metal siding not attached to grounded structure shall be bonded together and to ground.

D. Reinforcing steel and metal accessories shall be bonded to structures.

E. Where equipment grounding conductors are indicated, separate insulated conductors shall be installed within each feeder and branch circuit raceway. Ends shall be terminated on suitable lug, bus, or bushing.

3.7 FIELD QUALITY CONTROL

A. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.

3.8 GROUNDING SYSTEM TESTS

A. Suitable test instruments shall be used to measure resistance to ground of system. Testing shall be performed in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

B. The grounding test shall comply with IEEE Standard 81. A plot of ground resistance readings for each isolated ground rod or ground mat shall be submitted on 8-1/2 x 11 inch size graph paper. The current reference rod shall be driven at least 100 feet from the ground rod or grid under test. The measurements shall be made at 10-foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

C. A grounding system that shows greater than 5 ohm resistance for the flat portion of the plotted data shall be considered inadequately grounded. Additional parallel connected ground rods and/or deeper driven rods shall be provided until the ground resistance measurements complies with the indicated requirements. Use of salts, water or compounds to attain the specified ground resistance is not acceptable.

**** 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
3. Section 16170 Grounding System

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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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 in compliance with Section 2-5.3.1 of the Supplementary Special Provisions:

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. Where the electrical power supply to the LCP is 240 VAC single phase or 480 VAC 3-phase, as indicated on the electrical drawings or elsewhere, the LCP shall be provided with a control power transformer. 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. Enclosures shall be either freestanding, or designed to be mounted on pedestals or equipment skids or as indicated. Internal control components shall be mounted on a removable mounting pan. Interior of enclosure and mounting pan shall be finished white. Enclosure shall include 100-watt incandescent light (min.) designed to be controlled by a hand-operated switch and a circuit breaker and 15-amp duplex receptacle.

E. The main feeder disconnect shall be flange-mounted unless otherwise indicated.

F. 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.

G. Motor starters, where indicated, shall include contact closures for motor overload local indication and remote alarm.

H. 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.

I. Identification of panel-mounted devices, conductors, and electrical components shall comply with Section 16050.

J. LCPs shall include programmable logic controllers (PLCs) in accordance with Section 13300.

K. 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 contacts shall be installed in the ungrounded side of the circuit.

D. Signal and control wiring shall be separated and installed in separate wireways.

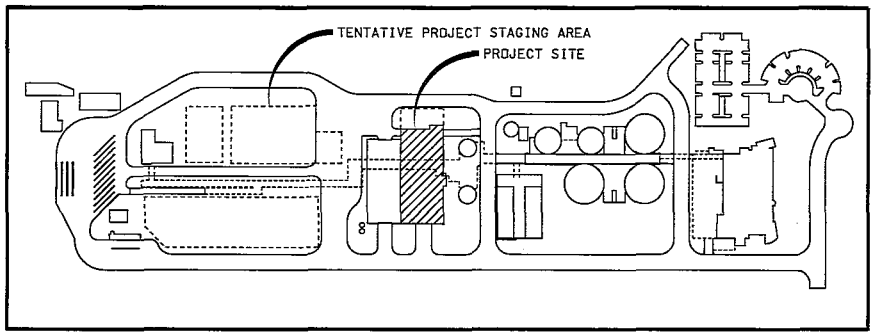
E. The panel shall be grounded to the plant grounding system as indicated.

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 ****

BRIDGING DOCUMENT DRAWINGS FOR
METROPOLITAN BIOSOLIDS CENTER
DEWATERING CENTRIFUGE REPLACEMENT



METROPOLITAN BIOSOLIDS CENTER
NO SCALE

GENERAL NOTES

STANDARD SPECIFICATIONS:

DOC. NO.	FILED	DESCRIPTION
1. PITS090110-1	09-01-10	STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (WHITEBOOK) 2010 EDITION.
2. PITS0504092	05-04-09	REGIONAL AND CITY OF SAN DIEGO SUPPLEMENT

LIST OF DRAWINGS

DRAWING No.	DESCRIPTION
FIGURE 1	COVER SHEET AND GENERAL NOTES
FIGURE 2	CENTRIFUGE LAYOUT PLAN – EXISTING AND PROPOSED
FIGURE 3	PROCESS FLOW DIAGRAM (FROM RECORD DRAWINGS)
FIGURE 4	CENTRIFUGE MODIFICATIONS – PLAN AND SECTION
FIGURE 5	CENTRIFUGE MODIFICATIONS – DETAILS
FIGURE 6	ELECTRICAL SINGLE LINE DIAGRAM (FROM RECORD DRAWINGS)
FIGURE 7	PIPING & INSTRUMENTATION DIAGRAM (FROM RECORD DRAWINGS)
FIGURE 8	COMMUNICATION BLOCK DIAGRAM

REFERENCE LOOP DRAWINGS (PER NOTE 10)

LD-MBC-76DCDL2 (1 of 3)	DEWATERING CENTRIFUGE 2 DATALINKS
LD-MBC-76DCDL2 (2 of 3)	DEWATERING CENTRIFUGE 2 DATALINKS
LD-MBC-76DCDL2 (3 of 3)	DEWATERING CENTRIFUGE 2 DATALINKS
LD-MBC-76Y0202 (1 of 3)	DEWAT CENTRIFUGE No. 2
LD-MBC-76Y0202 (2 of 3)	DEWAT CENTRIFUGE No. 2
LD-MBC-76Y0202 (3 of 3)	DEWAT CENTRIFUGE No. 2
LD-MBC-76Y0235 (1 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76Y0235 (2 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76Y0235 (3 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76Y0235 (4 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76Y0235 (5 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76Y0235 (6 of 6)	CENTRIFUGE BIN 2 SCREW FDR 1
LD-MBC-76T2566 (1 of 3)	DC 2 INLET SLUDGE TEMP
LD-MBC-76T2566 (2 of 3)	DC 2 INLET SLUDGE TEMP
LD-MBC-76T2566 (3 of 3)	DC 2 INLET SLUDGE TEMP

GENERAL PROJECT NOTES:

1. THE OWNER WILL NOT ENFORCE SAFETY MEASURES OR REGULATIONS. THE DESIGN-BUILDER SHALL DESIGN, CONSTRUCT AND MAINTAIN ALL SAFETY DEVICES AND SHALL BE SOLELY RESPONSIBLE FOR CONFORMING TO ALL LOCAL, STATE, AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS AND REGULATIONS.
2. THE DESIGN-BUILDER AGREES THAT THEY SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE DESIGN-BUILDER SHALL DEFEND, INDEMNIFY AND HOLD THE CITY HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE CITY.
3. ACCESS AND WORK HOURS AT THE SITE SHALL BE LIMITED TO THE HOURS OF 7:00 A.M. TO 3:30 P.M.
4. UPON COMPLETION OF EACH DAY'S WORK, THE DESIGN-BUILDER SHALL BE RESPONSIBLE FOR LEAVING THE WORK AREA FREE OF HAZARDS AND SHALL PROVIDE TEMPORARY SIGNS, WARNING DEVICES, BARRICADES, AND PLATES, AS NECESSARY.
5. THE DESIGN-BUILDER SHALL PROTECT EXISTING FACILITIES IN PLACE AND NOT INTERRUPT EXISTING FACILITIES OPERATION. ANY FACILITIES DAMAGED SHALL BE REPAIRED OR REPLACED IN KIND AS APPROVED BY THE OWNER AND AT NO COST TO THE OWNER.
6. THE DESIGN-BUILDER SHALL FIELD VERIFY ALL DRAWING DIMENSIONS AND THOSE TAKEN FROM RECORD DRAWINGS. THE DESIGN-BUILDER SHALL FIELD VERIFY ALL EXISTING CONDITIONS AT THE SITE AND CROSS CHECK DETAILS AND DIMENSIONS SHOWN ON ALL DRAWINGS HEREIN. THE DESIGN-BUILDER SHALL ALSO FIELD VERIFY ALL CONDITIONS INCLUDING, BUT NOT LIMITED TO, MEASUREMENTS, EXISTENCE, AND LOCATIONS OF EQUIPMENT AND ASSOCIATED PIPING, APPURTENANCES, VALVES, SUPPORTS, ETC. VARIATIONS IN CIVIL, STRUCTURAL OR MECHANICAL REQUIREMENTS MUST BE COORDINATED BEFORE THE DESIGN-BUILDER PROCEEDS WITH CONSTRUCTION. THE CONSTRUCTION MANAGER MUST BE NOTIFIED OF ANY DISCREPANCIES OR INCONSISTENCIES PRIOR TO ANY CONSTRUCTION.
7. WORKING DIMENSIONS SHALL NOT BE SCALED FROM PLANS, SECTIONS OR DETAILS FROM DRAWINGS CONTAINED HEREIN.
8. BACKGROUND DRAWINGS ARE DERIVED FROM RECORD DRAWINGS AND ARE NOT GUARANTEED ACCURATE. THE OWNER CAN PROVIDE NO GUARANTEE AS TO THE ACCURACY OF THE RECORD DRAWINGS. THEY HAVE BEEN USED FOR ILLUSTRATIVE PURPOSES ONLY.
9. FOR RECORD DRAWINGS SEE CITY OF SAN DIEGO PROJECT 27329-D.
10. REFERENCE LOOP DRAWINGS ARE PROVIDED TO SHOW LEVEL OF COMPLEXITY AND DETAIL. THE DESIGN-BUILDER IS RESPONSIBLE TO CONFIRM RECORD LOOP DRAWINGS AND MODIFY OR ADD LOOP DRAWINGS AS REQUIRED.

SUMMARY OF WORK:

THE WORK INVOLVES REPLACEMENT OF DEWATERING CENTRIFUGES 76-DC-2 THROUGH 76-DC-7 IN AREA 76 AT THE CITY OF SAN DIEGO'S METROPOLITAN BIOSOLIDS CENTER. IMPROVEMENTS INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

A. REMOVAL AND SALVAGE OF EXISTING CENTRIFUGES AND CONTROLS.

B. DEMOLITION AS NECESSARY TO ACCOMMODATE THE NEW CENTRIFUGES.

C. DESIGN AND INSTALLATION OF EQUIPMENT PADS, WIRING, PIPING, AND MISCELLANEOUS APPURTENANCES REQUIRED FOR OPERATION OF NEW CENTRIFUGES.

D. INSTALLATION OF TWO CENTRIFUGE FEED LINES AND MOTORIZED PINCH VALVES NECESSARY FOR OPERATION OF NEW CENTRIFUGES.

E. INSTALLATION OF SIX NEW DEWATERING CENTRIFUGES INCLUDING ALL APPURTENANCES.

F. INSTALLATION OF NEW CONTROL SYSTEM EQUIPMENT TO CONNECT NEW CENTRIFUGES TO THE SCADA SYSTEM.

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
COVER SHEET AND GENERAL NOTES

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 1 OF 8

WATER WBS N/A
SEWER WBS S-00339

F:\Projects\San Diego, City of (CA)_MWWD 2009-2011 As-Needed\141566 – MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 1.dgn
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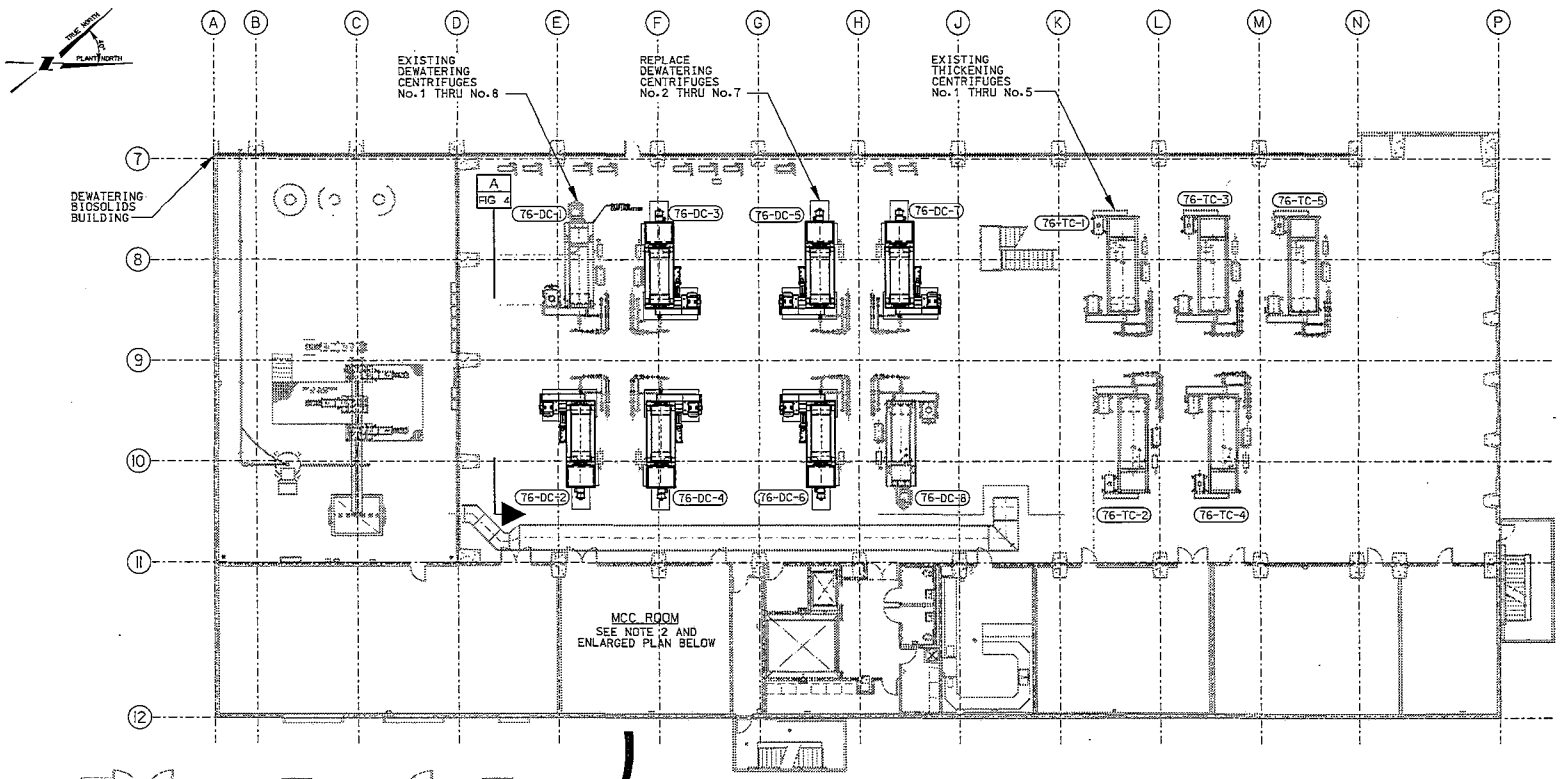
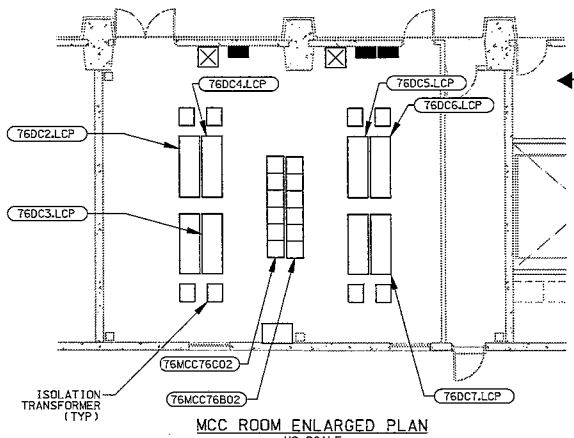


SECOND FLOOR PLAN
NO SCALE



MCC ROOM ENLARGED PLAN
NO SCALE

NOTES:

1. THE DESIGN-BUILDER SHALL REPLACE DEWATERING CENTRIFUGES 76-DC-2 THROUGH 76-DC-7. SEE SPECIFICATION SECTION 11397.
2. THE DESIGN-BUILDER SHALL INSTALL LOCAL CONTROL PANELS IN MCC ROOM.
3. FOR EXISTING SECOND FLOOR PLAN SEE RECORD DRAWING 27329-0176-D (SHEET 76-M-121).
4. FOR EXISTING MCC ROOM PLAN SEE RECORD DRAWING 27329-0546-D (SHEET 76-E-212).

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METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
CENTRIFUGE LAYOUT PLAN
EXISTING AND PROPOSED

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 2 OF 8

WATER WBS N/A
SEWER WBS S-00339

P:\Projects\San Diego, City of (CA)_MWWD 2008-2011 As-Needed\141566 - MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 2.dgn
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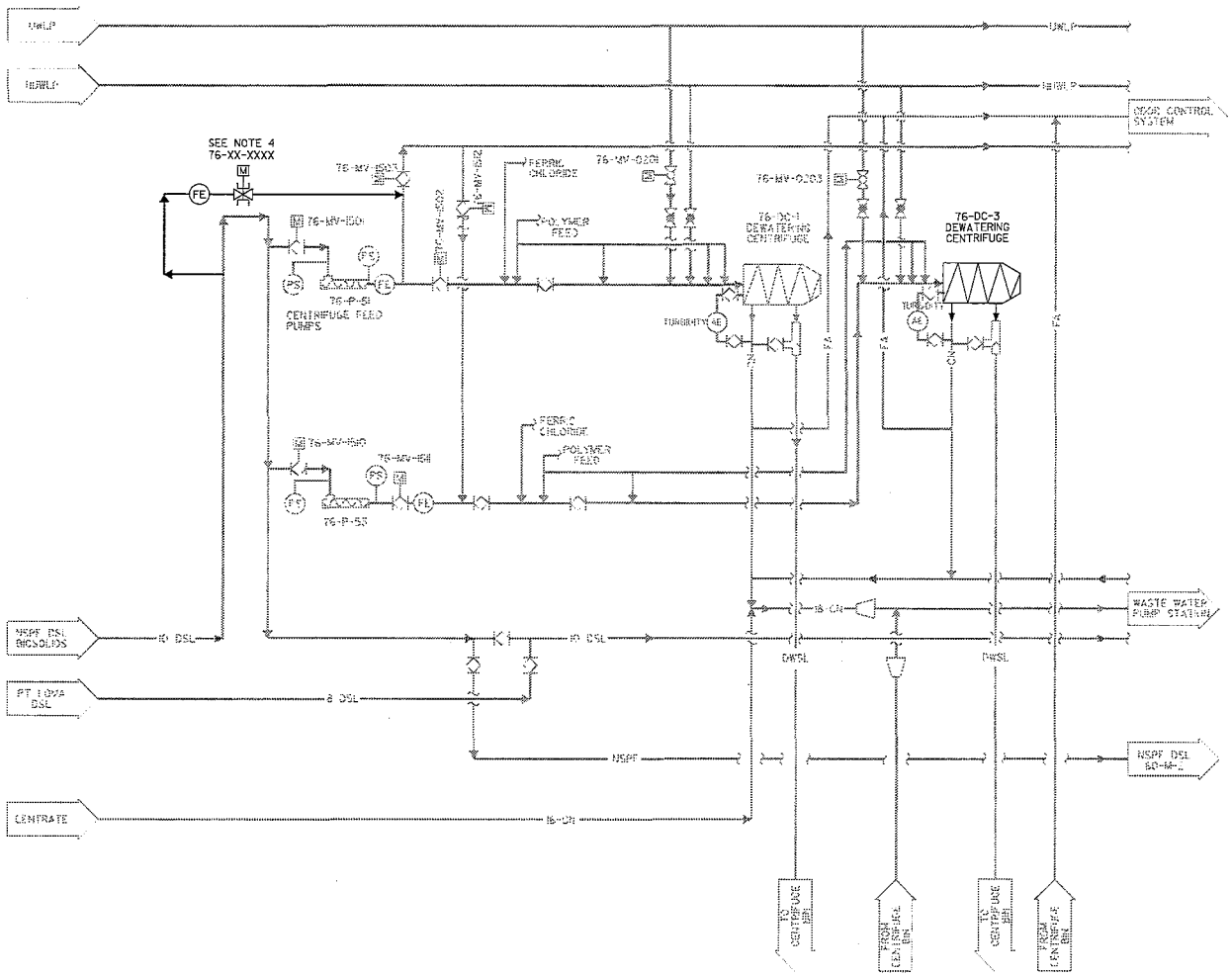

NOTES:

1. THE DESIGN-BUILDER SHALL REPLACE DEWATERING CENTRIFUGES 76-DC-2 THROUGH 76-DC-7. SEE SPECIFICATION SECTION 11397.
2. FOR LOCATIONS OF LOCAL CONTROL PANELS (LCP) SEE FIGURE 2 OF 8.
3. PROCESS FLOW DIAGRAM IS FOR ILLUSTRATION. SEE RECORD DRAWINGS 27329-0155-D (SHEET 76-M-4) AND 27329-0156-D (SHEET 76-M-5) FOR COMPLETE PROCESS FLOW DIAGRAM.
4. THE DESIGN-BUILDER SHALL FIELD LOCATE AND INSTALL MOTORIZED PINCH DIAPHRAGM VALVE AND FLOW ELEMENT AS SHOWN AT DEWATERING CENTRIFUGE (76-DC-1) FEED PUMP.
5. THE DESIGN-BUILDER SHALL ALSO FIELD LOCATE AND INSTALL MOTORIZED PINCH VALVE AND FLOW METER AT DEWATERING CENTRIFUGE 8 (76-DC-8) FEED PUMP (NOT SHOWN).
6. THE HEAT EXCHANGERS AND HOT WATER SUPPLY SYSTEM HAVE BEEN REMOVED FROM THE EXISTING PROCESS.

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METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
EXISTING PROCESS FLOW DIAGRAM (DEWATERING)

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 3 OF 8

WATER WBS N/A
SEWER WBS S-00339

P:\Projects\San Diego, City of (CA)_MWWD 2008-2011 As-Needed\141566 - MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 3.dgn
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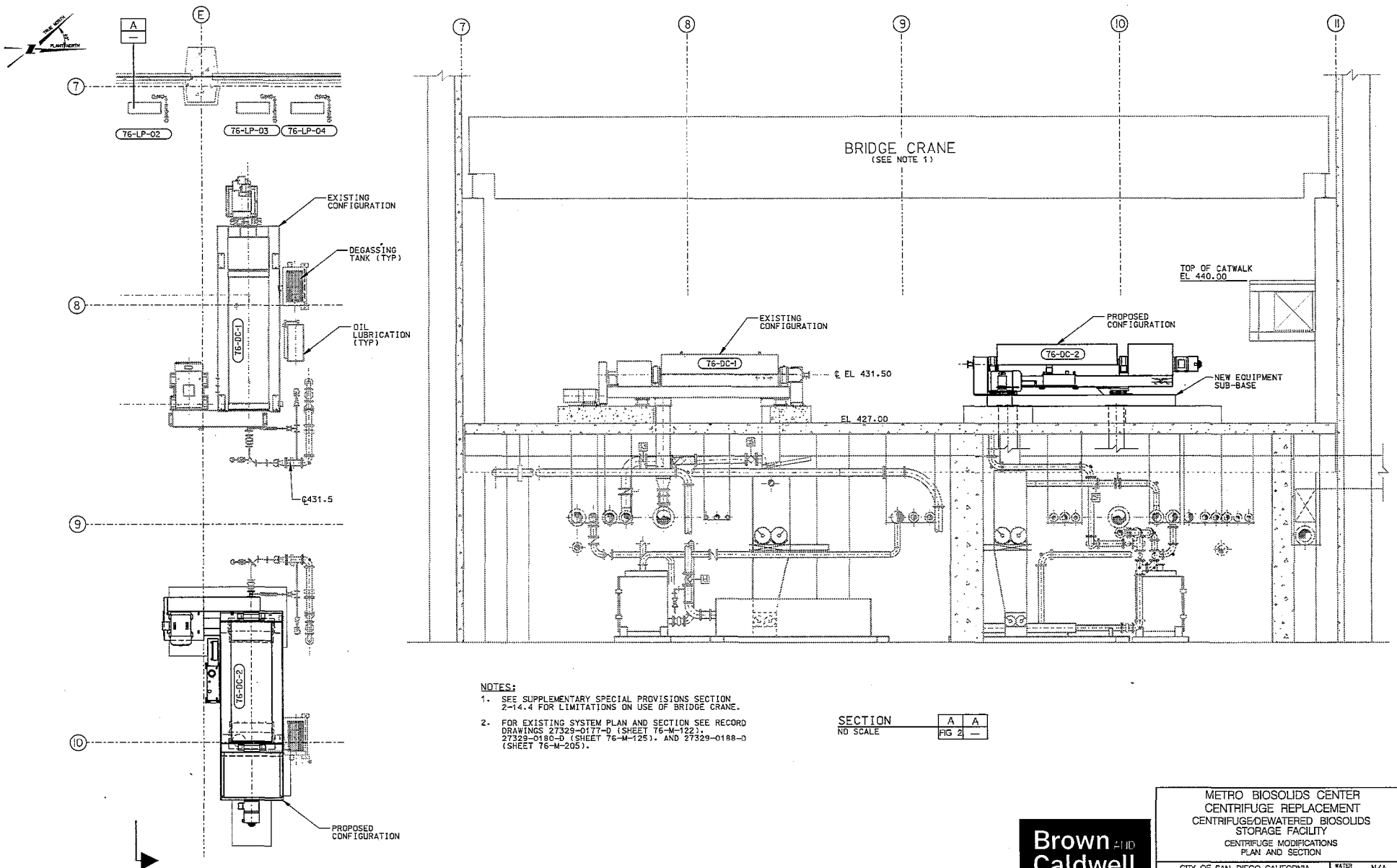

NOTES:

1. SEE SUPPLEMENTARY SPECIAL PROVISIONS SECTION 2-14.4 FOR LIMITATIONS ON USE OF BRIDGE CRANE.
2. FOR EXISTING SYSTEM PLAN AND SECTION SEE RECORD DRAWINGS 27329-0177-D (SHEET T6-M-122), 27329-0180-D (SHEET T6-M-125), AND 27329-0188-D (SHEET T6-M-205).

SECTION A A
NO SCALE FIG 2 —

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
CENTRIFUGE MODIFICATIONS
PLAN AND SECTION

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 4 OF 8

WATER WBS N/A
SEWER WBS S-00339

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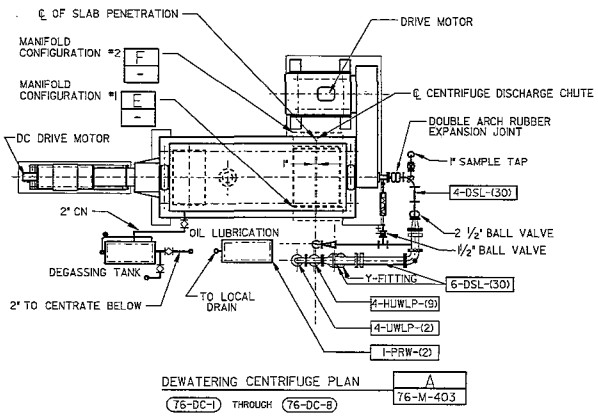
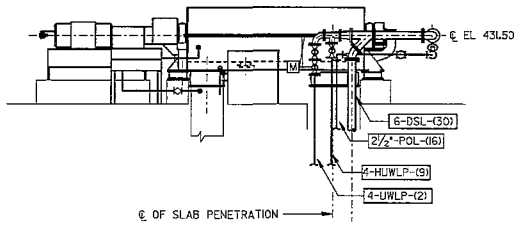
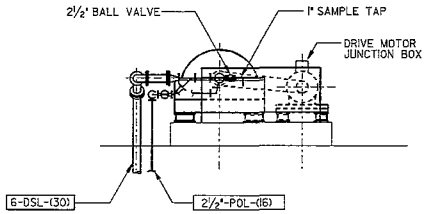


DEWATERING CENTRIFUGE PLAN — A / 76-M-403

76-DC-1 THROUGH 76-DC-8



SIDE VIEW — 76-M-403



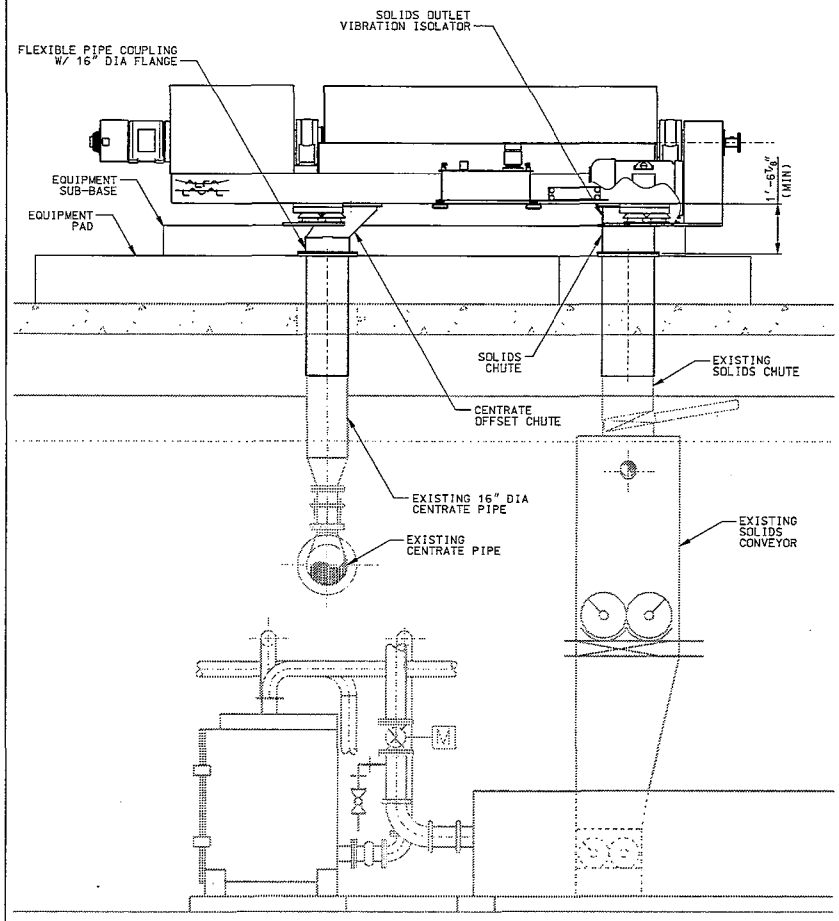
FRONT VIEW — 2 / 76-M-403

RECORD DRAWING FROM WHICH DETAIL WAS REFERENCED (TYP)

NOTES:
1. ALL PIPING WILL BE SCHEDULE 80 PVC
2. PVC HOSE WILL BE 2" CLEAR VIEW REINFORCED PVC HOSE CAPABLE OF A WORKING PRESSURE OF 125 PSI. THE PVC HOSE WILL BE LONG ENOUGH SO AS NOT TO INDUCE STRESS ON THE PVC PIPING SUPPORTED BY THE CENTRIFUGE.
3. ADJUST ISOLATION BALL VALVES TO PROVIDE A FLOW OF 30 GPM TO THE THREE FLUSH CONNECTION PORTS.

EXISTING CENTRIFUGE DETAILS

PER RECORD DRAWING 23729-0194-D (SHEET 76-M-403)



NOTE:
SECTION VIEW AS SHOWN IS ONLY A REPRESENTATION OF POSSIBLE EQUIPMENT ORIENTATION AND CONNECTION TO EXISTING PIPING AND SOLIDS CONVEYANCE SYSTEMS. THE DESIGN-BUILDER SHALL CONSULT WITH THE CENTRIFUGE MANUFACTURER FOR POSSIBLE CONFIGURATIONS AND FIELD VERIFY ALL DIMENSIONS, PIPING, SLAB OPENINGS, ETC. DURING THE DESIGN AND PROSECUTION OF THE WORK.

NEW CENTRIFUGE DETAIL — 1 / —
NO SCALE

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METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
EXISTING AND NEW MECHANICAL DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 5 OF 8

WATER WBS N/A
SEWER WBS S-00339

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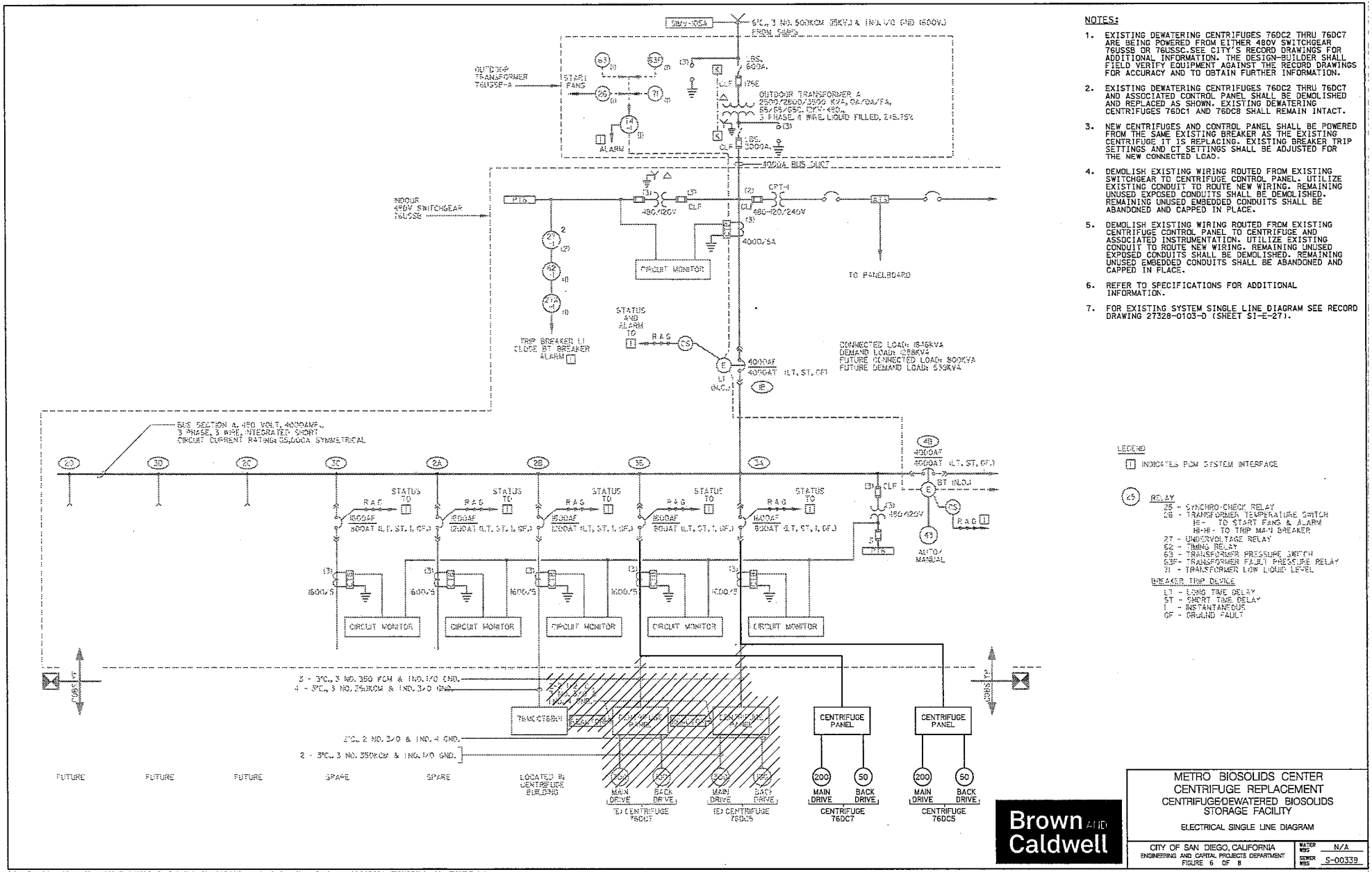


NOTES:

1. EXISTING DEWATERING CENTRIFUGES 76DC2 THRU 76DC7 ARE BEING POWERED FROM EITHER 480V SWITCHGEAR 76U35B OR 76U35C. SEE CITY'S RECORD DRAWINGS FOR ADDITIONAL INFORMATION. THE DESIGN-BUILDER SHALL FIELD VERIFY EQUIPMENT AGAINST THE RECORD DRAWINGS FOR ACCURACY AND TO OBTAIN FURTHER INFORMATION.
2. EXISTING DEWATERING CENTRIFUGES 76DC2 THRU 76DC7 AND ASSOCIATED CONTROL PANEL SHALL BE DEMOLISHED AND REPLACED AS SHOWN. EXISTING DEWATERING CENTRIFUGES 76DC1 AND 76DC8 SHALL REMAIN INTACT.
3. NEW CENTRIFUGES AND CONTROL PANEL SHALL BE POWERED FROM THE SAME EXISTING BREAKER AS THE EXISTING CENTRIFUGE IT IS REPLACING. EXISTING BREAKER TRIP SETTINGS AND CT SETTINGS SHALL BE ADJUSTED FOR THE NEW CONNECTED LOAD.
4. DEMOLISH EXISTING WIRING ROUTED FROM EXISTING SWITCHGEAR TO CENTRIFUGE CONTROL PANEL. UTILIZE EXISTING CONDUIT TO ROUTE NEW WIRING. REMAINING UNUSED EXPOSED CONDUITS SHALL BE DEMOLISHED. REMAINING UNUSED EMBEDDED CONDUITS SHALL BE ABANDONED AND CAPPED IN PLACE.
5. DEMOLISH EXISTING WIRING ROUTED FROM EXISTING CENTRIFUGE CONTROL PANEL TO CENTRIFUGE AND ASSOCIATED INSTRUMENTATION. UTILIZE EXISTING CONDUIT TO ROUTE NEW WIRING. REMAINING UNUSED EXPOSED CONDUITS SHALL BE DEMOLISHED. REMAINING UNUSED EMBEDDED CONDUITS SHALL BE ABANDONED AND CAPPED IN PLACE.
6. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
7. FOR EXISTING SYSTEM SINGLE LINE DIAGRAM SEE RECORD DRAWING 27328-0103-D (SHEET SI-E-27).

LEGEND

[1] INDICATES PCM SYSTEM INTERFACE

(25) RELAY
- 25 - SYNCHRO-CHECK RELAY
- 26 - TRANSFORMER TEMPERATURE SWITCH
  - H - TO START FANS & ALARM
  - HH - TO TRIP MAIN BREAKER
- 27 - UNDERVOLTAGE RELAY
- 62 - TIMING RELAY
- 63 - TRANSFORMER PRESSURE SWITCH
- 63F - TRANSFORMER FAULT PRESSURE RELAY
- 71 - TRANSFORMER LOW LIQUID LEVEL

BREAKER TRIP DEVICE
- LT - LONG TIME DELAY
- ST - SHORT TIME DELAY
- I - INSTANTANEOUS
- GF - GROUND FAULT

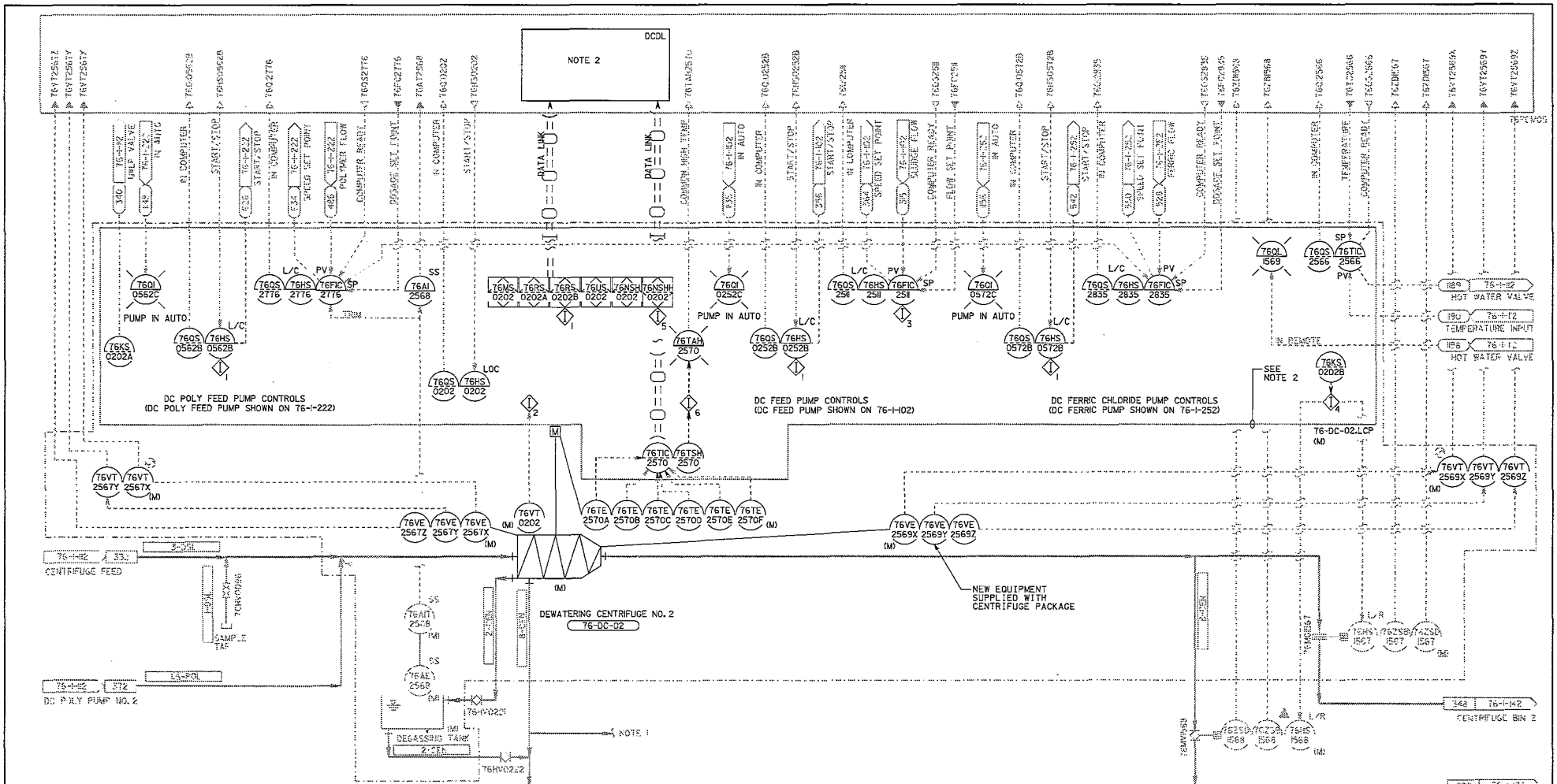
Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY

ELECTRICAL SINGLE LINE DIAGRAM

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 6 OF 8

WATER WBS N/A
SEWER WBS S-00339



CENTRIFUGE INTERLOCKS:

1. START POLYMER, SLUDGE, AND FERRIC FEED PUMPS WHEN THE CENTRIFUGE REACHES OPERATING SPEED AND STOP PUMPS WHEN CENTRIFUGE STOPS.
2. STOP CENTRIFUGE UPON HIGH VIBRATION CONDITION AND LOCKOUT WITH A MANUAL RESET.
3. OVERRIDE THE SLUDGE FEED FLOWRATE DURING HIGH TORQUE CONDITIONS. WHEN TORQUE RETURNS TO A NORMAL LEVEL, RELEASE SLUDGE FEED RATE TO ORIGINAL SETPOINT.
4. OPEN DISCHARGE GATE AND CLOSE BYPASS TO CENTRATE PLUG VALVE AFTER AN ADJUSTABLE TIME DELAY UPON CENTRIFUGE STARTUP.
5. STOP CENTRIFUGE UPON HIGH-HIGH TORQUE CONDITION AND LOCKOUT WITH MANUAL RESET.
6. STOP CENTRIFUGE UPON HIGH MOTOR WINDING TEMPERATURE AND LOCKOUT WITH MANUAL RESET.

NOTES:
1. SEE DWG 76-I-302 FOR THE FOUL AIR SYSTEM.
2. FOR DATA LINK I/O POINT LISTING SEE SPECIFICATION SECTION 13301APPENDICES D AND E

NOTES:
1. FOR EXISTING SYSTEM PIPING AND INSTRUMENTATION DIAGRAM SEE RECORD DRAWING 27329-0343-D (SHEET 76-I-122).
2. PROVIDE ALL CONTROL CAPABILITY FROM EXISTING PANEL INTO NEW SOFTWARE AND DISPLAYS ON THE NEW CENTRIFUGE PANEL.

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
PIPING AND INSTRUMENTATION DIAGRAM

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 7 OF 8

WATER WBS N/A
SEWER WBS S-00339

P:\Projects\San Diego, City of (CA)_MWWD 2009-2011 As-Needed\141566 - MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 7.dgn
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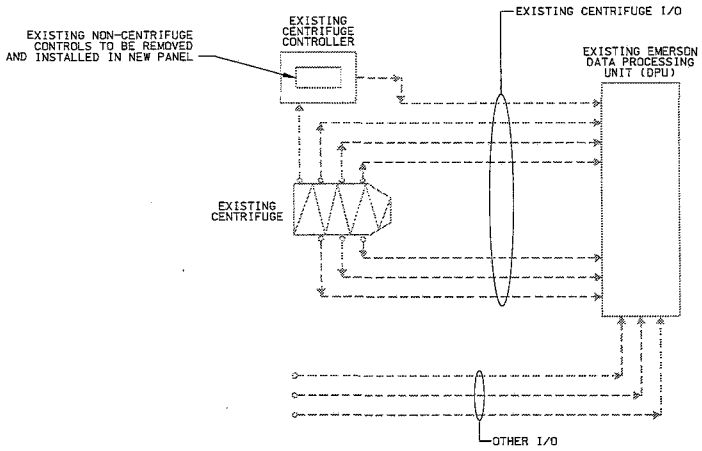
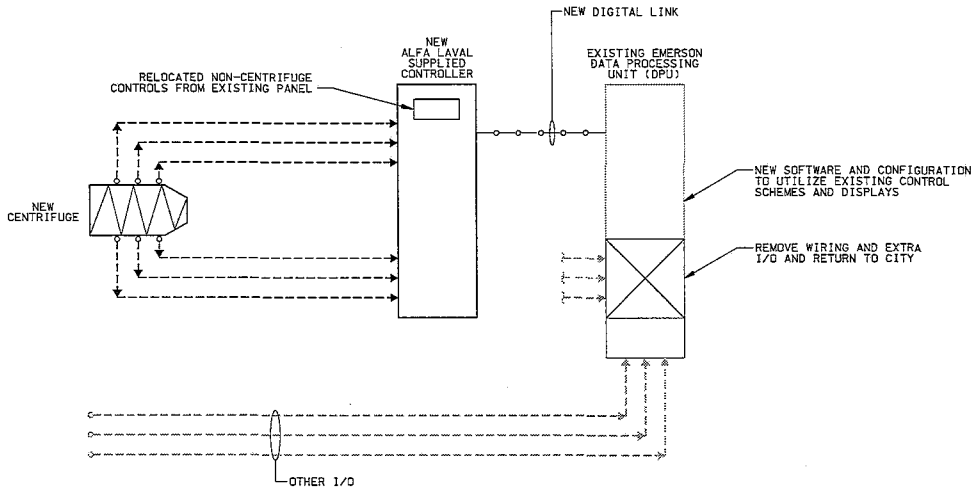


EXISTING SYSTEM



PROPOSED SYSTEM

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
COMMUNICATION BLOCK DIAGRAM

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 8 OF 8

WATER WBS N/A
SEWER WBS S-00339

P:\Projects\San Diego, City of (CA)_MWWD 2008-2011 As-Needed\141566 - MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 8.dgn
09-OCT-2012 11:58 rkulnys

LOOP NO:
76DCDL2 - (76PCM05)

INSTRUMENT LOOP DIAGRAM DEVICE

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	ENG UNITS	DATA TYPE	QUERY REGISTER TYPE	SLAVE ADDRESS	MOD BUS ADDRESS	SCALE	LINK RESOLUTION	FIELD DEVICE	P&ID	LOOP VIEW LEVELS	INTERCONNECT VIEW LEVELS
M	76	TI	2570	A	DEWAT CFUGE 2 MOTOR TEMP 1	DEGREES C	AI	IR	1	30031	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11
M	76	TI	2570	B	DEWAT CFUGE 2 MOTOR TEMP 2	DEGREES C	AI	IR	1	30032	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11
M	76	TI	2570	C	DEWAT CFUGE 2 MOTOR TEMP 3	DEGREES C	AI	IR	1	30033	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11
M	76	TI	2570	D	DEWAT CFUGE 2 MOTOR TEMP 4	DEGREES C	AI	IR	1	30034	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11
M	76	TI	2570	E	DEWAT CFUGE 2 MOTOR TEMP 5	DEGREES C	AI	IR	1	30035	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11
M	76	TI	2570	F	DEWAT CFUGE 2 MOTOR TEMP 6	DEGREES C	AI	IR	1	30036	0-200°C	UINT16	MULTILIN 269	76-I-122	2 AND 10	3 AND 11

76DCDL2 - (76PCM07)

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	ENG UNITS	DATA TYPE	QUERY REGISTER TYPE	SLAVE ADDRESS	MOD BUS ADDRESS	SCALE	LINK RESOLUTION	FIELD DEVICE	P&ID	LOOP VIEW LEVELS	INTERCONNECT VIEW LEVELS
M	76	MI	0202		DEWAT CFUGE 2 RUNNING	N/A	DI	HR	1	41500.03	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	NAH	0202		DEWAT CFUGE 2 HIGH TORQUE	N/A	DI	HR	1	41500.02	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	NAHH	0202		DEWAT CFUGE 2 HI-HI TORQUE	N/A	DI	HR	1	41500.01	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	RI	0202	A	DEWAT CFUGE 2 READY AC POWER	N/A	DI	HR	1	41500.05	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	RI	0202	B	DEWAT CFUGE 2 AT SPEED	N/A	DI	HR	1	41500.04	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	UA	0202		DEWAT CFUGE 2 COMMON FAIL	N/A	DI	HR	1	41500.00	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	QI	1567		DEWAT CFUGE 2 DIVERTER GATE IN AUTO	N/A	DI	HR	1	41500.10	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	FVZQ	0202		DEWAT CFUGE 2 FLUSH VLV OPND/CLSD	N/A	DI	HR	1	41500.11	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	FVSS	0202		DEWAT CFUGE 2 FLUSH VLV AUTO/LOCAL	N/A	DI	HR	1	41500.12	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	FVLS	0202		DEWAT CFUGE 2 FLUSH VLV LOCAL STATUS	N/A	DI	HR	1	41500.13	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	QS	0202	A	DEWAT CFUGE 2 BACK DRIVE MODE	N/A	DO	PMR	1	41501.01	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	HS	1567	A	DEWAT CFUGE 2 DISCH DIVERTER GATE SOLIDS	N/A	DO	PMR	1	41501.02	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	HS	1567	B	DEWAT CFUGE 2 DISCH DIVERT GATE CENTRATE	N/A	DO	PMR	1	41501.03	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	QS	1567		DEWAT CFUGE 2 DISCH DIVERTER GATE AUTO	N/A	DO	PMR	1	41501.04	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	FVQI	0202		DEWAT CFUGE 2 FLUSH VLV DCS/LOCAL	N/A	DO	PMR	1	41501.05	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	FVHS	0202		DEWAT CFUGE 2 FLUSH VLV OPEN/CLOSE CMND	N/A	DO	PMR	1	41501.06	N/A	BIT	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	QS	0202	B	DEWAT CFUGE 2 BACKDRIVE LOAD	PCT	AI	HR	1	41503.00	0-100	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	SI	0202	A	DEWAT CFUGE 2 BOWL SPEED	RPM	AI	HR	1	41504.00	0-4000	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	SI	0202	B	DEWAT CFUGE 2 BACKDRIVE DIFF	RPM	AI	HR	1	41505.00	0-10	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	SI	0202	C	DEWAT CFUGE 2 PINION SPEED	RPM	AI	HR	1	41506.00	0-4000	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	II	202	A	DEWAT CFUGE 2 MAIN DRIVE MOTOR AMPS	AMPS	AI	HR	1	41507.00	0-600	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11
M	76	QC	0202		DEWAT CFUGE 2 BACKDRIVE LOAD/DIFF SETPOINT	PCTRPM	AO	PMR	1	41512.00	0-100	UINT16	SQ-D CRM-570	76-I-122	2 AND 10	3 AND 11

THIS SHEET VIEW LEVELS 1 AND 9
FOR CONTINUTATION VIEW LEVELS 2 AND 10

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chris
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REFERENCE DRAWINGS
P&ID DWG. NO. 76-I-122
CONDUIT DWG. NO. 76-E-212. 76-E-214/216
CONDUIT & WIRE SCHEDULE 76-E-517
SHARPLES WIRING DIAGRAMS #6149.5124-7082 (7 SHTS)
CENTRIFUGE PROCURMENT SUB-0015. 0017. 0046

Destroy all prints bearing earlier date

Rev	Date	DESCRIPTION	By	Ckd	Approvals Proj Engr	Proj Mgr
2	7/31/00	FINAL AS BUILT	VG	DM		
3	8/13/02	PICK UP REVIEW COMMENTS	MB			
4	8/11/04	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129
PES JOB NO. 95-653
FILE: 76DCD2A.DGN

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
DEWATERING CENTRIFUGE 2 DATALINKS

LOOP NO.	DWG No.	SH	OF	SH	REV
76DCDL2	LD-MBC-76DCDL2	1	OF	3	4

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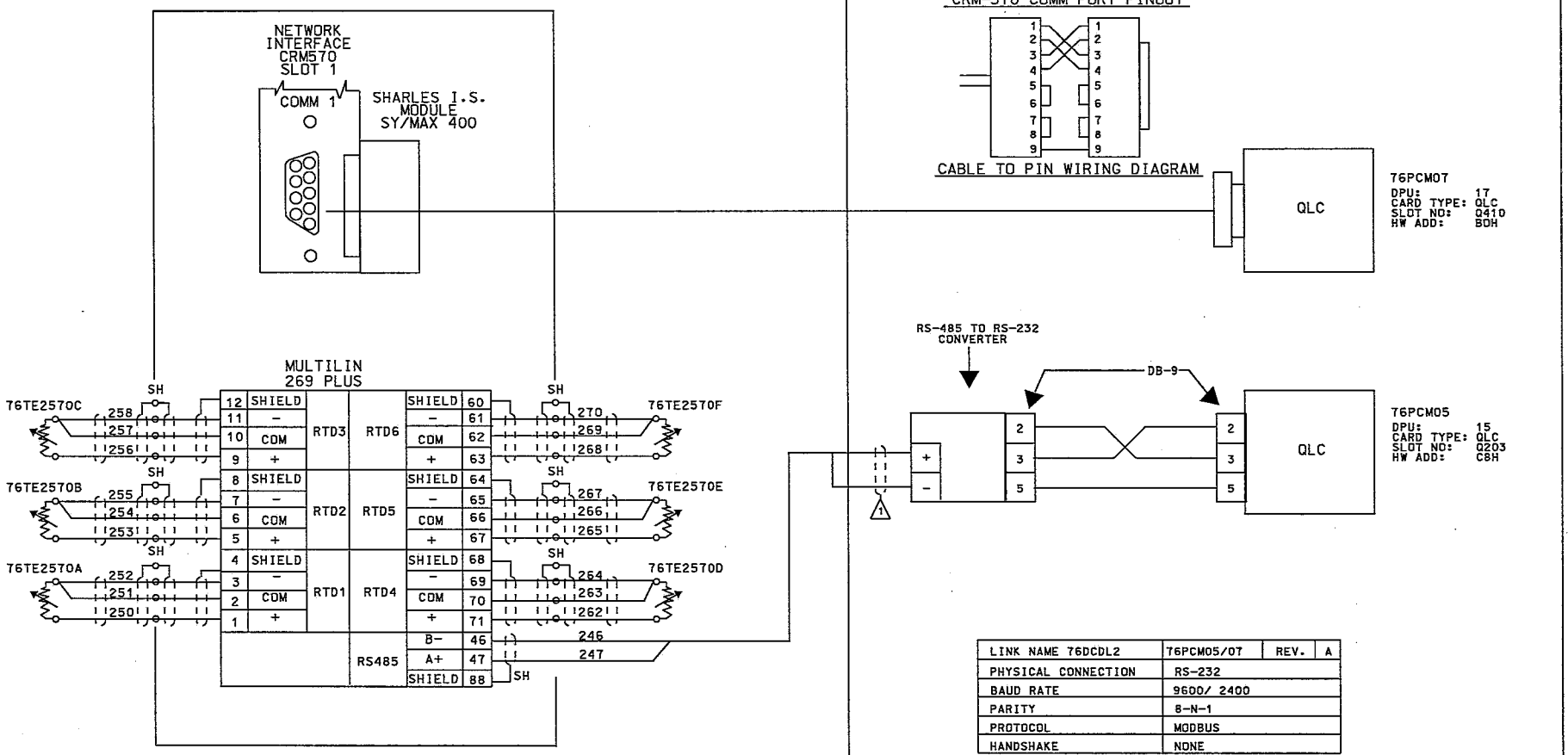
FIELD



LINK NAME 76DCDL2	76PCM05/07 REV. A
PHYSICAL CONNECTION	RS-232
BAUD RATE	9600/ 2400
PARITY	8-N-1
PROTOCOL	MODBUS
HANDSHAKE	NONE

NOTE:

⚠1 FLOATING SHIELD: CUT, COIL AND TAPE SHIELD DRAIN WIRE.

THIS SHEET VIEW LEVELS 2 AND 10
FOR CONTINUATION VIEW LEVELS 3 AND 11

REFERENCE DRAWINGS
P&ID DWG. NO. 76-I-122
CONDUIT DWG. NO. 76-E-212, 76-E-214/316
CONDUIT & WIRE SCHEDULE 76-E-517
SHARPLES WIRING DIAGRAMS #6149.5124-7082 (7 SHTS)
CENTRIFUGE PROCURMENT SUB-0015, 0017, 0046

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd
2	7/31/00	FINAL AS BUILT	VG	DM
3	8/13/02	PICK UP REVIEW COMMENTS	MB	
4	8/11/04	PICK UP REVIEW COMMENTS	CW	

Approvals: Proj Engr | Proj Mgr

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

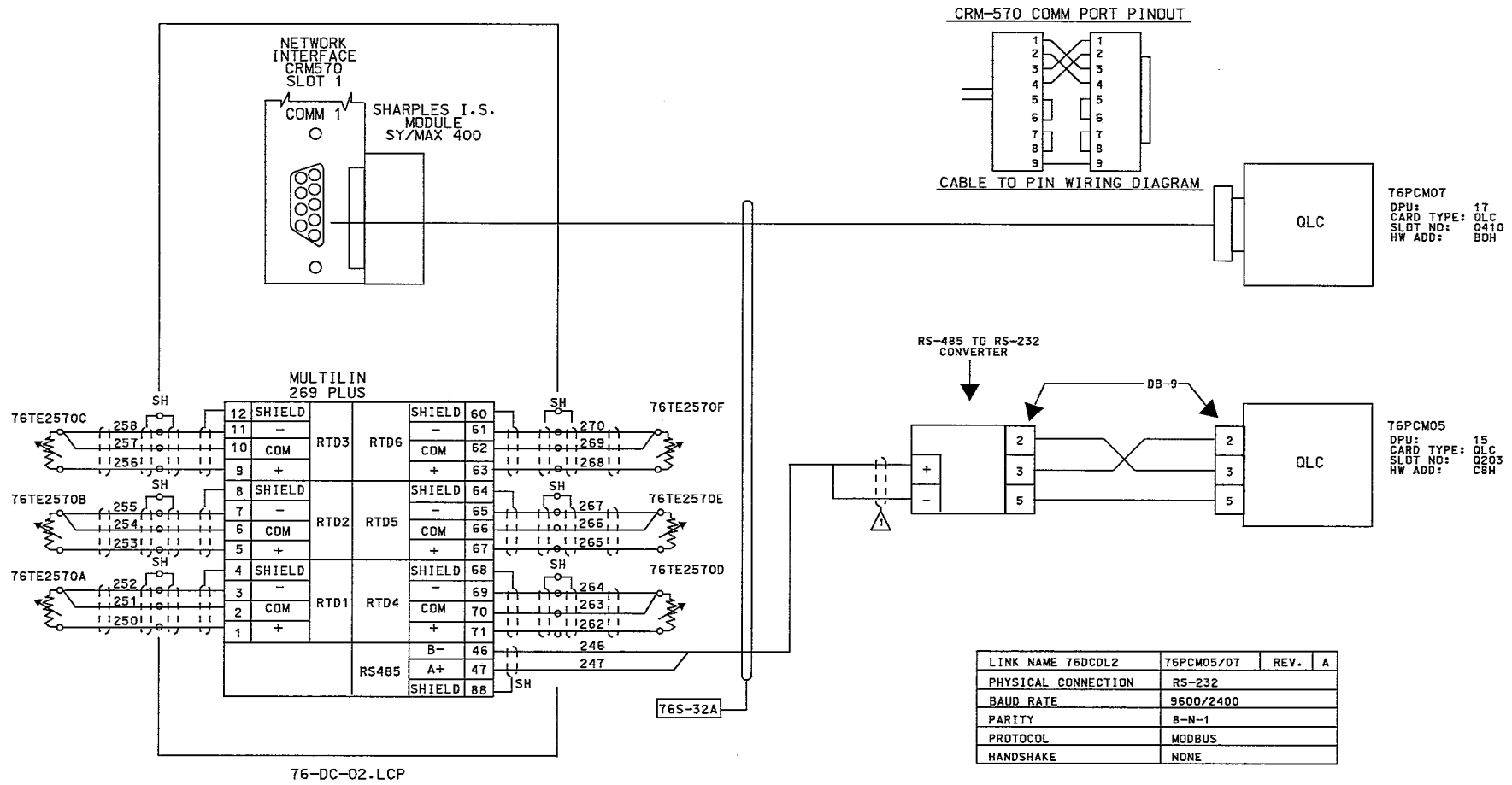
PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129
PES JOB NO. 95-653
FILE: 76DCD2A.DGN

INSTRUMENT LOOP DIAGRAM
DEWATERING CENTRIFUGE 2 DATALINKS

LOOP NO. 76DCDL2 | DWG No. LD-MBC-76DCDL2 | SH 2 OF 3 | SH 3 | REV 4



LINK NAME 76DCDL2	76PCM05/07	REV.	A
PHYSICAL CONNECTION	RS-232		
BAUD RATE	9600/2400		
PARITY	8-N-1		
PROTOCOL	MODBUS		
HANDSHAKE	NONE		

NOTE:

⚠1 FLOATING SHIELD: CUT, COIL AND TAPE SHIELD DRAIN WIRE.

THIS SHEET VIEW LEVELS 3 AND 11

REFERENCE DRAWINGS
P&ID DWG. NO. 76-I-122
CONDUIT DWG. NO. 76-E-212, 76-E-212, 76-E-214/216
CONDUIT & WIRE SCHEDULE 76-E-517
SHARPLES WIRING DIAGRAMS #6149.5124-7082 (7 SHTS)
CENTRIFUGE PROCURMENT SUB-0015, 0017, 0046

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals Proj Engr	Proj Mgr
2	7/31/00	FINAL AS BUILT	VG	DM		
3	8/13/02	PICK UP REVIEW COMMENTS	MB			
4	8/11/04	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129

PES JOB NO. 95-653

INTERCONNECTION DIAGRAM
DEWATERING CENTRIFUGE 2 DATALINKS

FILE: 76DCD2A.DGN

LOOP NO.	DWG No.	SH	SH	REV
76DCDL2	LD-MBC-76DCDL2	3	OF 3	4

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LOOP NO:
76Y0202

INSTRUMENT LOOP DIAGRAM DEVICE

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL No	SPEC No	AREA CONTRACTOR	SUBMITTAL No	REMARKS
M	76	VT	0202		DEWAT CFUGE NO. 2	VIBRATION	XMTR/SWITCH	76-DC-02	VITEC	438	11397	SHARPLES	30A.17.15	CENTRIFUGE PROCUREMENT
M	76	HS	0202		DEWAT CFUGE NO. 2	L/O/C: START/STOP	3 POS. SEL. SWT	76-DC-02.LCP	SQUARE D	9001-SKS43B	11397	SHARPLES	30A.17.15	CENTRIFUGE PROCUREMENT
M	76	HS	0202		DEWAT CFUGE NO. 2	START/STOP	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	QS	0202		DEWAT CFUGE NO. 2	IN COMP	3 POS. SEL. SWT	76-DC-02.LCP	SQUARE D	9001-SKS43B	11397	SHARPLES	30A.17.15	CENTRIFUGE PROCUREMENT
M	76	QI	0202		DEWAT CFUGE NO. 2	IN COMP	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	HS	0202	A	FLUSH WATER	LOCAL/REMOTE	2 POS. SEL. SWT	76MV0202	ROTORK	AQ830	15101	NDBJV	602-20	
M	76	KS	0202	A	FLUSH WATER	INTERLOCK	RELAY/CONTACT	76-DC-02.LCP	SQUARE D	8501-KUI3-M1P14V20	13397	SHARPLES	30A.17.15.46	CENTRIFUGE PROCUREMENT
M	76	HS	0202		FLUSH WATER	HAND/OFF/AUTO	3 POS. SEL. SWT	76-DC-02.LCP	SQUARE D	900-SK43J38W	13397	SHARPLES	30A.17.15.46	CENTRIFUGE PROCUREMENT
M	76	KS	0202	B	SOLIDS BY-PASS VALVE	INTERLOCK	RELAY/CONTACT	76-DC-02.LCP	SQUARE D	8501-KUI3-M1P14V20	13397	SHARPLES	30A.17.15.46	CENTRIFUGE PROCUREMENT

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	DATA SH No	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	AREA LOOP DIAGRAM No	P&ID DWG No	LOOP VIEW LEVELS	INTERCONNECT VIEW LEVELS
M	76	VT	0202		DEWAT CFUGE NO. 2	N/A	N/A	4-20MA	0-3	IN/SEC	1	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	HS	0202		DEWAT CFUGE NO. 2	N/A	N/A	120VAC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	HS	0202		DEWAT CFUGE NO. 2	N/A	DO	120VAC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	QS	0202		DEWAT CFUGE NO. 2	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	QI	0202		DEWAT CFUGE NO. 2	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	HS	0202	A	FLUSH WATER	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-112	2 AND 10	3 AND 11
M	76	KS	0202	A	FLUSH WATER	N/A	N/A	120VAC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	HS	0202		FLUSH WATER	N/A	N/A	120VAC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11
M	76	KS	0202	B	SOLIDS BY-PASS VALVE	N/A	N/A	120VAC	N/A	N/A	N/A	LD-MBC-76Y0202	76-I-122	2 AND 10	3 AND 11

THIS SHEET VIEW LEVELS 1 AND 9

REFERENCE DRAWINGS

- P&ID DRAWING NO. 76-I-122, 112
- ELECTRICAL PLAN DRAWING NO. 76-E-111A
- CONDUIT SCHEDULE 76-E-525
- SHARPLES WIRING DIAGRAM 6149.5124-7082
- ROTORK WIRING DIAGRAM WD16546-01
- LOOP DIAGRAMS LD-MBC-76DCD2
- LD-MBC-76Y1567 & 76Y1568

Destroy all prints bearing earlier date

Rev	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	7/9/97	FINAL SUBMITTAL	JC	RJ		
1	6/14/99	AS BUILT	CC	RJ		
2	7/31/00	FINAL AS BUILT	RB	DM		
3	4/11/02	PICK UP REVIEW COMMENTS	MB			
4	10/10/03	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129

PES JOB NO. 95-653

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
DEWAT CENTRIFUGE NO. 2

FILE: 76Y0202.DGN

LOOP NO.	DWG No.	SH	OF	SH	REV
76Y0202	LD-MBC-76Y0202	1	OF	3	4

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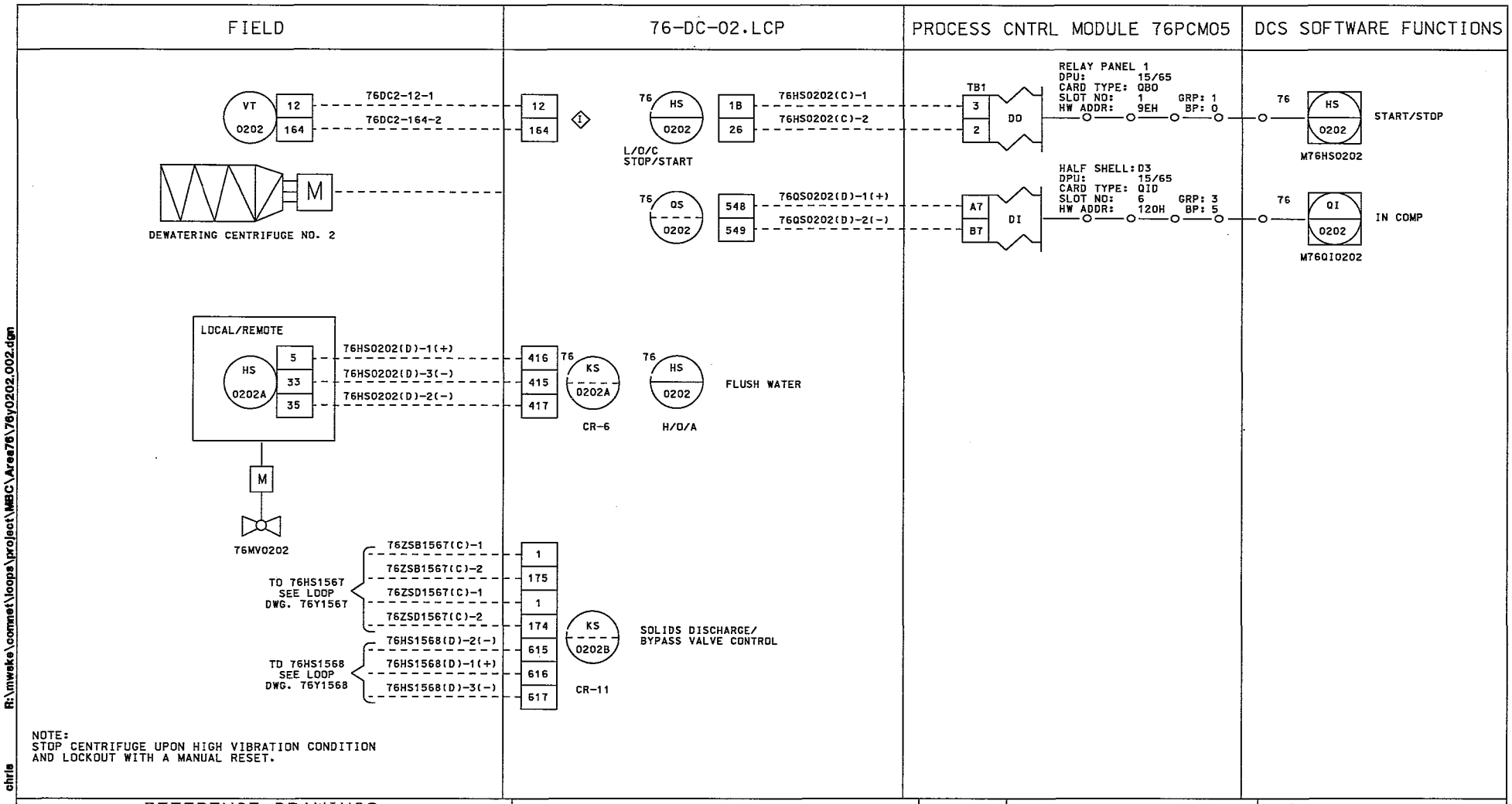


NOTE:
STOP CENTRIFUGE UPON HIGH VIBRATION CONDITION AND LOCKOUT WITH A MANUAL RESET.

REFERENCE DRAWINGS
P&ID DRAWING NO. 76-I-122. 112
ELECTRICAL PLAN DRAWING NO. 76-E-111A
CONDUIT SCHEDULE 76-E-525
SHARPLES WIRING DIAGRAM 6149.5124-7082
ROTORK WIRING DIAGRAM WD16546-01
LOOP DIAGRAMS LD-MBC-76DCD2,
LD-MBC-76Y1567 & 76Y1568

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd
A	2/18/97	INTERIM SUBMITTAL	JC	RR
B	7/9/97	FINAL SUBMITTAL	JC	RJ
1	5/28/98	AS BUILT	CC	RJ
2	7/31/00	FINAL AS BUILT	RB	DM
3	4/11/02	PICK UP REVIEW COMMENTS	MB	
4	10/10/03	PICK UP REVIEW COMMENTS	CW	

Approvals: Proj Engr | Proj Mgr

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

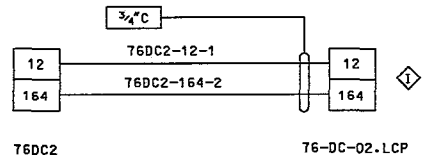
METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

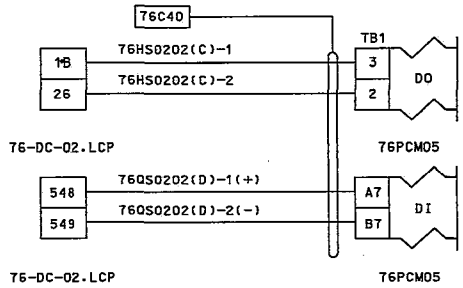
WESTINGHOUSE PROJECT NO. CD129
PES JOB NO. 95-653
FILE: 76Y0202.DGN

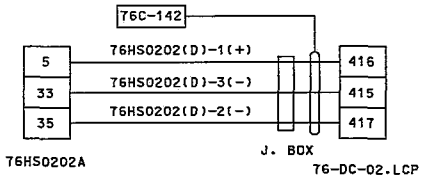
INSTRUMENT LOOP DIAGRAM
DEWAT CENTRIFUGE NO. 2

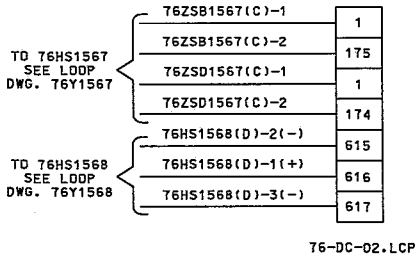
LOOP NO.	DWG No. LD-MBC-76Y0202	SH	SH	REV
76Y0202		2	OF 3	4

05-AUG-2007 16:11 chris R:\mwske\comet\loops\project\MBC\Area76\76y0202.002.dgn









NOTE:
STOP CENTRIFUGE UPON HIGH VIBRATION CONDITION
AND LOCKOUT WITH A MANUAL RESET.

REFERENCE DRAWINGS
P&ID DRAWING NO. 76-I-122, 112
ELECTRICAL PLAN DRAWING NO. 76-E-111A
CONDUIT SCHEDULE 76-E-525
SHARPLES WIRING DIAGRAM 6149.5124-7082
ROTORK WIRING DIAGRAM WD16546-01
LOOP DIAGRAMS LD-MBC-76DCD1,
LD-MBC-76Y1567 & 76Y1568

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals Proj Engr	Approvals Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	7/9/97	FINAL SUBMITTAL	JC	RJ		
1	5/28/98	AS BUILT	CC	RJ		
2	7/31/00	FINAL AS BUILT	RB	DM		
3	4/11/02	PICK UP REVIEW COMMENTS	MB			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129
PES JOB NO. 95-653
FILE: 76Y0202.DGN

INTERCONNECTION DIAGRAM
DEWAT CENTRIFUGE NO. 2

LOOP NO.	DWG No.	SH	SH	REV
76Y0202	LD-MBC-76Y0202	3	OF 3	3

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LOOP NO:
76Y0235

INSTRUMENT LOOP DIAGRAM DEVICE

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL No	SPEC No	AREA CONTRACTOR	SUBMITTAL No	REMARKS
M	76	NT	0235		CNTRFGE BIN 2 SCREW FDR 1	TORQUE SIGNAL	VFD	76VFD2A	ROBICON	454GT	11032	NDBJV	602-2	
M	76	NAH	0235		CNTRFGE BIN 2 SCREW FDR 1	TORQUE HIGH	PILOT LIGHT	76-B-02.LCP	SQUARE D	9001SKT1G31	11800	NDBJV	602-12	
M	76	NA	0235		CNTRFGE BIN 2 SCREW FDR 1	TORQUE HIGH	RELAY	76-B-02.LCP	ACTION INSTR.	AP1680	11800	NDBJV	602-12	
M	76	UA	0235	A	CNTRFGE BIN 2 SCREW FDR 1	TORQUE HIGH	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	QS	0235		CNTRFGE BIN 2 SCREW FDR 1	IN COMP	SELECTOR SWITCH	76VFD2A	ELECTRO-SWITCH	31306A	11032	NDBJV	602-2	
M	76	QI	0235		CNTRFGE BIN 2 SCREW FDR 1	IN COMP	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	HS	0235		CNTRFGE BIN 2 SCREW FDR 1	FORWARD/REVERSE	SELECTOR SWITCH	76VFD2A	ELECTRO-SWITCH	31306A	11032	NDBJV	602-2	
M	76	MS	0235	A	CNTRFGE BIN 2 SCREW FDR 1	RUNNING FORWARD	RELAY	76VFD2A	P&B	KUP-14A35-120V	11032	NDBJV	602-2	
M	76	MI	0235	A	CNTRFGE BIN 2 SCREW FDR 1	RUNNING FORWARD	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	MS	0235	B	CNTRFGE BIN 2 SCREW FDR 1	RUNNING REVERSE	RELAY	76VFD2A	P&B	KUP-14A35-120V	11032	NDBJV	602-2	
M	76	MI	0235	B	CNTRFGE BIN 2 SCREW FDR 1	RUNNING REVERSE	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	RS	0235		CNTRFGE BIN 2 SCREW FDR 1	AC READY	RELAY	76VFD2A	P&B	KUP-14A35-120V	11032	NDBJV	602-2	
M	76	RI	0235		CNTRFGE BIN 2 SCREW FDR 1	AC READY	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	US	0235	B	CNTRFGE BIN 2 SCREW FDR 1	COMMON FAIL	RELAY	76VFD2A	P&B	KUP-14A35-120V	11032	NDBJV	602-2	
M	76	UA	0235	B	CNTRFGE BIN 2 SCREW FDR 1	COMMON FAIL	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	ST	0235		CNTRFGE BIN 2 SCREW FDR 1	SCREW SPEED	VFD	76VFD2A	ROBICON	454 GT	11032	NDBJV	602-2	
M	76	ST	0235		CNTRFGE BIN 2 SCREW FDR 1	SCREW SPEED	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	XS	0235		CNTRFGE BIN 2 SCREW FDR 1	ZERO SPEED	MOTION ALARM	76-B-02.LCP	MILLTRONICS	MFA-4P	11800	NDBJV	602-12	
M	76	XA	0235		CNTRFGE BIN 2 SCREW FDR 1	ZERO SPEED	DCS	76PCM07	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	SIC	0235		CNTRFGE BIN 2 SCREW FDR 1	SPEED CONTROL	VFD	76VFD2A	ROBICON	454 GT	11032	NDBJV	602-2	
M	76	XE	0235		CNTRFGE BIN 2 SCREW FDR 1	SPEED	SENSOR	76-B-02	MILLTRONICS	DSD-3	11800	NDBJV	602-12	

THIS SHEET VIEW LEVELS 1 AND 9
FOR CONTINUATION SEE VIEW LEVELS 2 AND 10

REFERENCE DRAWINGS

- P&ID DRAWING NO. 76-I-142
- CONDUIT PLAN DWG. 76-E-101
- CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
- ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
- ASDOR PANEL ASSEMBLY #5098-A-01 & 02
- WIRING DIAGRAM 76-E-318
- ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

Rev	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	8/1/97	FINAL SUBMITTAL	VR	RJ		
1	6/15/99	AS BUILT	JC	RJ		
2	7/31/00	FINAL AS BUILT	VG	DM		
3	4/11/02	PICK UP REVIEW COMMENTS	MB			
4	10/17/03	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129
PES JOB NO. 95-653
FILE: 76Y0235.DGN

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
CENTRIFUGE BIN 2 SCREW FDR 1

LOOP NO. 76Y0235 | DWG No. LD-MBC-76Y0235 | SH 1 OF SH 6 | REV 4

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chris
06-AUG-2007 13:41

LOOP NO: 76Y0235

INSTRUMENT LOOP DIAGRAM DEVICE

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DIAGRAM NO	P&ID DWG NO	LOOP VIEW LEVELS	INTERCONNECT VIEW LEVELS
M	76	NT	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	AO	4-20MA	0-100	PERCENT	85	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	NAH	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	120VAC	N/A	PERCENT	85	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	NA	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	PERCENT	85	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	UA	0235	A	CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	QS	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	QI	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	HS	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	120VAC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	MS	0235	A	CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	MI	0235	A	CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	MS	0235	B	CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	MI	0235	B	CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	3 AND 11	5 AND 13
M	76	RS	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	RI	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	US	0235	B	CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	UA	0235	B	CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	ST	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	4-20MA	0-100	PERCENT	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	ST	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	AI	4-20MA	0-100	PERCENT	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	XS	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	24VDC	N/A	SPEED	0	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	XA	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	SIC	0235		CNTRFGE BIN 2 SCREW FDR 1	S20.1a	AI	4-20MA	0-100	PERCENT	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14
M	76	XE	0235		CNTRFGE BIN 2 SCREW FDR 1	N/A	N/A	MILIPULSE	N/A	SPEED	N/A	LD-MBC-76Y0235	76-I-142	4 AND 12	6 AND 14

THIS SHEET VIEW LEVELS 2 AND 10

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chris
06-AUG-2007 13:41

REFERENCE DRAWINGS

- P&ID DRAWING NO. 76-I-142
- CONDUIT PLAN DWG. 76-E-101
- CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
- ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
- ASDOR PANEL ASSEMBLY #5098-A-01 & 02
- WIRING DIAGRAM 76-E-318
- ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

Rev	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	8/1/97	FINAL SUBMITTAL	VR	RJ		
1	6/15/99	AS BUILT	JC	RJ		
2	4/11/02	PICK UP REVIEW COMMENTS	MB			
3	10/17/03	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

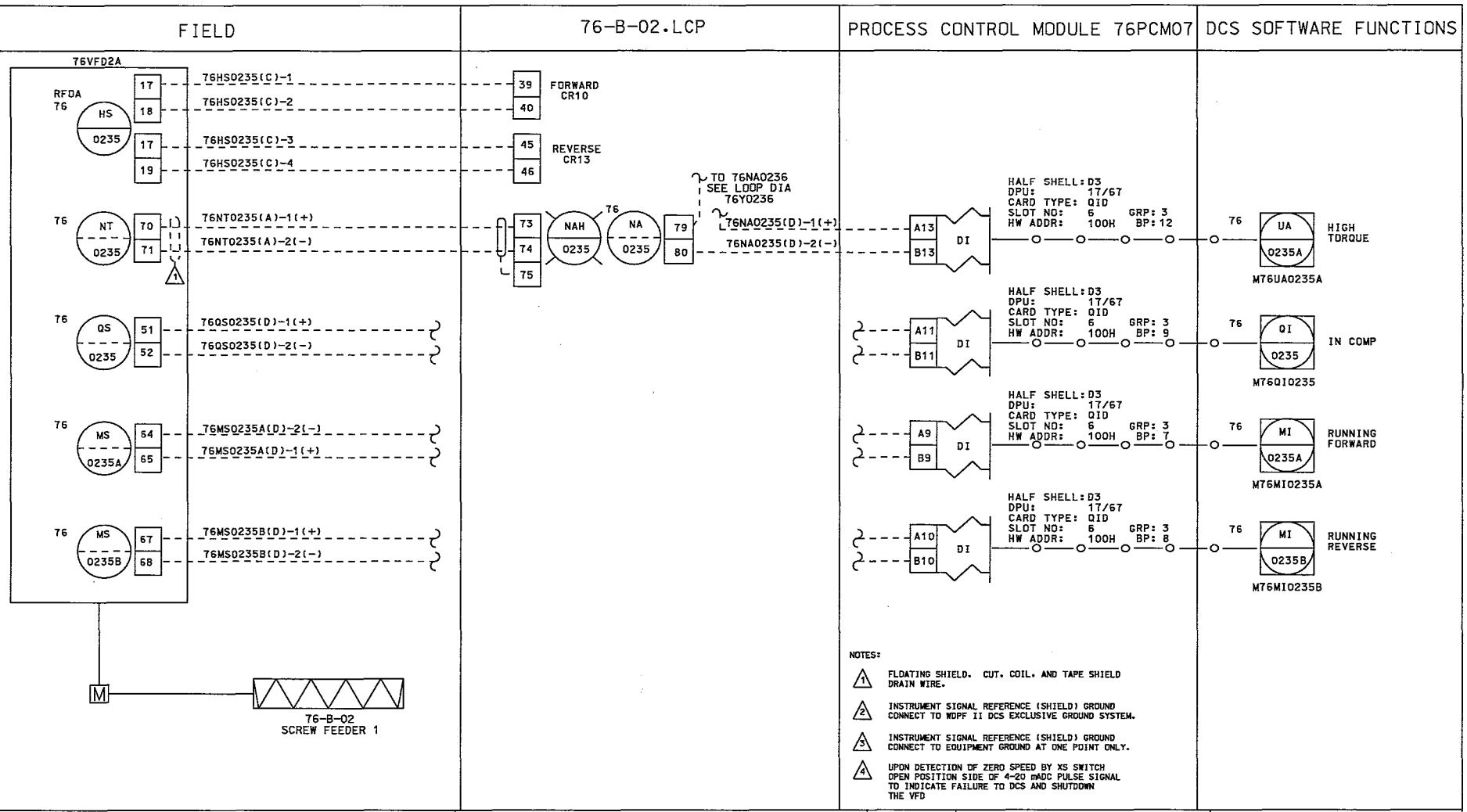
WESTINGHOUSE PROJECT NO. C0129

PES JOB NO. 95-653

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
CENTRIFUGE BIN 2 SCREW FDR 1

FILE: 76Y0235.DGN

LOOP NO.	DWG No.	SH	OF	SH	REV
76Y0235	LD-MBC-76Y0235	2	OF	6	3



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REFERENCE DRAWINGS

P&ID DRAWING NO. 76-I-142
CONDUIT PLAN DWG. 76-E-101
CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
ASDOR PANEL ASSEMBLY #5098-A-01 & 02
WIRING DIAGRAM 76-E-318
ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd
A	2/18/97	INTERIM SUBMITTAL	JC	RR
B	8/1/97	FINAL SUBMITTAL	VR	RJ
1	5/26/98	AS BUILT	JC	RJ
2	7/31/00	FINAL AS BUILT	VG	DM
3	4/11/02	PICK UP REVIEW COMMENTS	MB	
4	10/17/03	PICK UP REVIEW COMMENTS	CW	

Approvals

Proj Engr	Proj Mgr

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

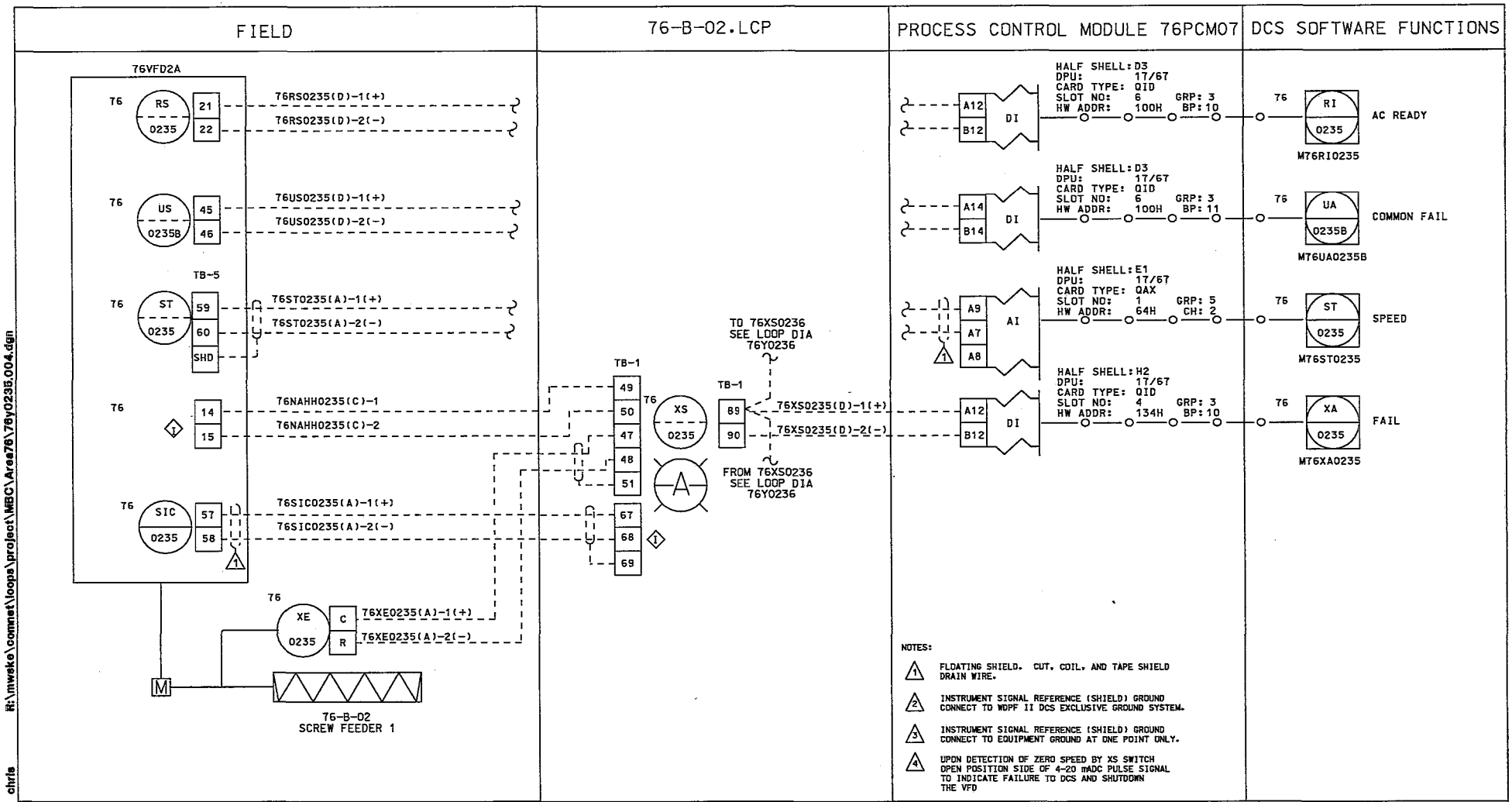
PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. CD129
PES JOB NO. 95-653
FILE: 76Y0235.DGN

INSTRUMENT LOOP DIAGRAM
CENTRIFUGE BIN 2 SCREW FDR 1

LOOP NO.	DWG No.	SH	SH	REV
76Y0235	LD-MBC-76Y0235	3	OF 6	4



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REFERENCE DRAWINGS
P&ID DRAWING NO. 76-I-142
CONDUIT PLAN DWG. 76-E-101
CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
ASDOR PANEL ASSEMBLY #5098-A-01 & 02
WIRING DIAGRAM 76-E-318
ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	8/1/97	FINAL SUBMITTAL	VR	RJ		
1	5/26/98	AS BUILT	JC	RJ		
2	7/31/00	FINAL AS BUILT	VG	DM		
3	4/11/02	PICK UP REVIEW COMMENTS	MB			
4	10/17/03	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

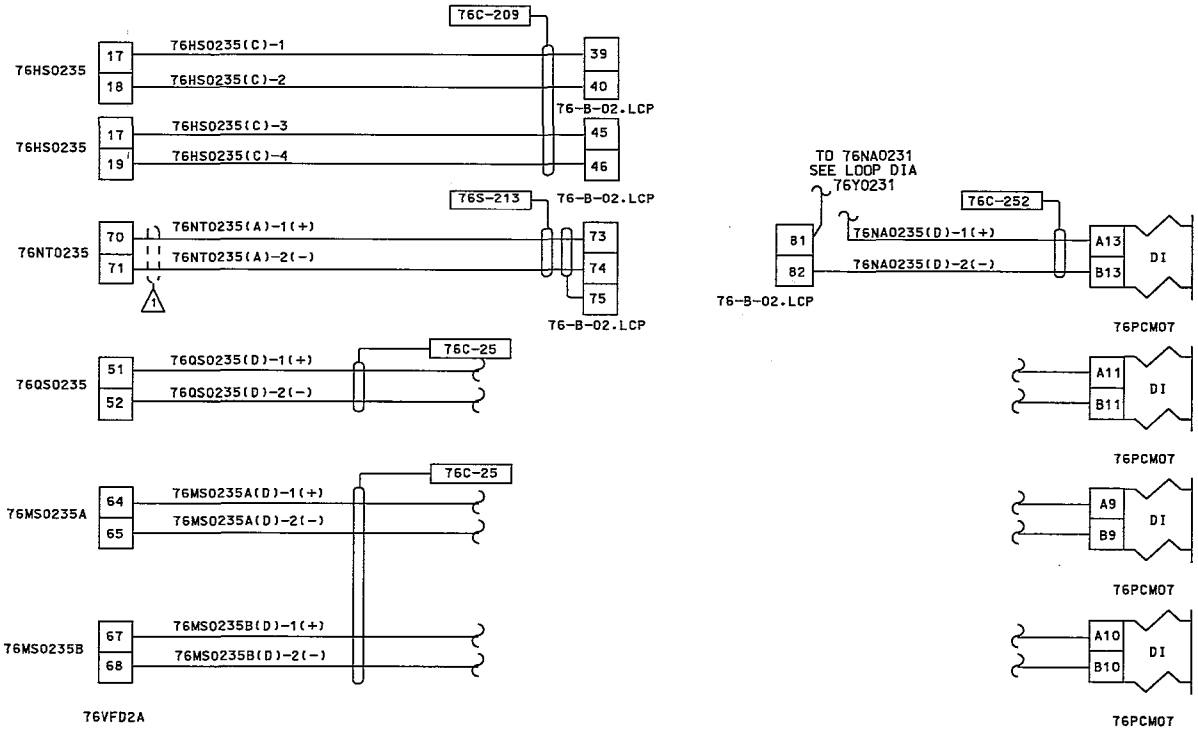
PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. CD129
PES JOB NO. 95-653
FILE: 76Y0235.DGN

INSTRUMENT LOOP DIAGRAM
CENTRIFUGE BIN 2 SCREW FDR 1

LOOP NO. 76Y0235
DWG No. LD-MBC-76Y0235
SH 4 OF SH 6
REV 4



NOTES:

1. FLOATING SHIELD. CUT, COIL, AND TAPE SHIELD DRAIN WIRE.
2. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPF II DCS EXCLUSIVE GROUND SYSTEM.
3. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY.
4. UPON DETECTION OF ZERO SPEED BY XS SWITCH OPEN POSITION SIDE OF 4-20 mADC PULSE SIGNAL TO INDICATE FAILURE TO DCS AND SHUTDOWN THE VFD

REFERENCE DRAWINGS
P&ID DRAWING NO. 76-I-142
CONDUIT PLAN DWG. 76-E-101
CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
ASDOR PANEL ASSEMBLY #5098-A-01 & 02
WIRING DIAGRAM 76-E-318
ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
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WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. CD129

PES JOB NO. 95-653

INTERCONNECTION DIAGRAM
CENTRIFUGE BIN 2 SCREW FDR 1

FILE: 76Y0235.DGN

LOOP NO.	DWG No. LD-MBC-76Y0235	SH	SH	REV
76Y0235		5	OF 6	4

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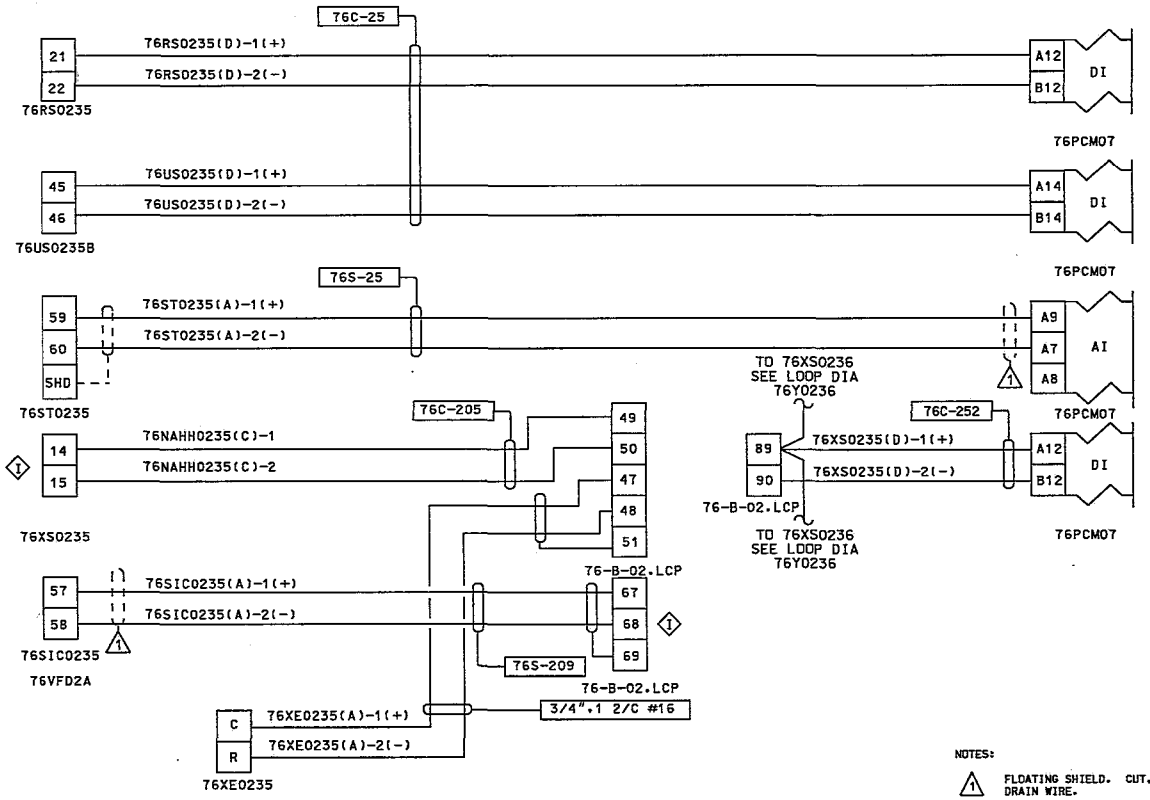
chris
08-AUG-2007 13:41



NOTES:

1. FLOATING SHIELD. CUT, COIL, AND TAPE SHIELD DRAIN WIRE.
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CONDUIT SCHEDULE DWG. 76-E-523, 527, 528, 521, 517
ASDOR WIRING DIAGRAM # 5098-E-00 THUR. 03
ASDOR PANEL ASSEMBLY #5098-A-01 & 02
WIRING DIAGRAM 76-E-318
ROBICON VFD WIRING #457140

Destroy all prints bearing earlier date

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A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	8/1/97	FINAL SUBMITTAL	VR	RJ		
1	5/26/98	AS BUILT	JC	RJ		
2	7/31/00	FINAL AS BUILT	VG	DM		
3	4/11/02	PICK UP REVIEW COMMENTS	MB			
4	10/17/03	PICK UP REVIEW COMMENTS	CW			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. CD129
PES JOB NO. 95-653
FILE: 76Y0235.DGN

INTERCONNECTION DIAGRAM
CENTRIFUGE BIN 2 SCREW FDR 1

LOOP NO. 76Y0235
DWG No. LD-MBC-76Y0235
SH 6 OF 6
REV 4

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LOOP NO:
76T2566

INSTRUMENT LOOP DIAGRAM DEVICE

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL No	SPEC No	AREA CONTRACTOR	SUBMITTAL No	REMARKS
M	76	TE	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	TEMP	ELEMENT	SLUDGE FEED	WILCON	W04-6"	13301	WPCD	109A-MBC	
M	76	TIT	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	TEMP	XMTR	SLUDGE FEED	SMAR	TT301-10-10-0	13301	WPCD	109A-MBC	
M	76	TT	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	TEMP	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	TIC	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	TEMP	CNTRLR	76DC02.LCP	FISHER-PORTER	53MC5000	11397	NDBJV	30A	CP SUB-0015
M	76	TC	2566		DC HEAT EXCHANGER 2 VLV POSITION	TEMP SET	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	QS	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	COMPUTER READY	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	QI	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	IN COMP	DCS	76PCM05	WESTINGHOUSE	WDPF II	13400	WPCD	200	
M	76	QS	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	IN COMP	CONTACT	76DC02.LCP	SQUARE D	9001 H KR-1	11397	NDBJV	30A	CP SUB-0015

N	UP #	TAG PRE	TAG No	TG LR	EQUIPMENT SERVICE	DATA SH No	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	AREA LOOP DIAGRAM No	P&ID DWG No	LOOP VIEW LEVELS	INTERCONNECT VIEW LEVELS
M	76	TE	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	S20.12a	RTD	MILLIVOLT	(-)200-(+)1200	DEG F	N/A	LD-MBC-76T2566	76-I-112	2 AND 10	3 AND 11
M	76	TIT	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	S20.11	N/A	HART/4-20MA	35-150	DEG F	N/A	LD-MBC-76T2566	76-I-112	2 AND 10	3 AND 11
M	76	TT	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	N/A	AI	HART	70-150	DEG F	N/A	LD-MBC-76T2566	76-I-112	2 AND 10	3 AND 11
M	76	TIC	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	S20.1a	AI/AO	4-20MA	30-150	DEG F	N/A	LD-MBC-76T2566	76-I-122	2 AND 10	3 AND 11
M	76	TC	2566		DC HEAT EXCHANGER 2 VLV POSITION	N/A	AO	4-20MA	0-100	PCT	N/A	LD-MBC-76T2566	76-I-122	2 AND 10	3 AND 11
M	76	QS	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	N/A	DO	24VDC	N/A	N/A	N/A	LD-MBC-76T2566	76-I-122	2 AND 10	3 AND 11
M	76	QI	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	N/A	DI	24VDC	N/A	N/A	N/A	LD-MBC-76T2566	76-I-122	2 AND 10	3 AND 11
M	76	QS	2566		DEWTR CFUGE 2 INLET SLUDGE TEMP	N/A	N/A	24VDC	N/A	N/A	N/A	LD-MBC-76T2566	76-I-122	2 AND 10	3 AND 11

THIS SHEET VIEW LEVELS 1 AND 9

REFERENCE DRAWINGS

- P&ID DRAWING NO. 76-I-112/122
- CONDUIT PLAN DWG. 76-E-101B/161
- CONDUIT SCHEDULE 76-E-517 THRU 526
- BROWN AUTOMATION O&M MANUAL-VOLUME 3 OF 4. SECTION 17
- SHARPLES DWG. 6149.5124-7082 SH.1-7

Destroy all prints bearing earlier date

Rev	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	7/7/97	FINAL SUBMITTAL	JC	RJ		
1	6/14/99	AS BUILT	VR	RJ		
2	7/31/00	FINAL AS BUILT	VG	DM		
3	2/21/02	PICK UP REVIEW COMMENTS	MB			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129

PES JOB NO. 95-653

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
DC 2 INLET SLUDGE TEMP

FILE: 76T2566.DGN

LOOP NO.	DWG No.	SH	SH	REV
76T2566	LD-MBC-76T2566	1 OF	3	3

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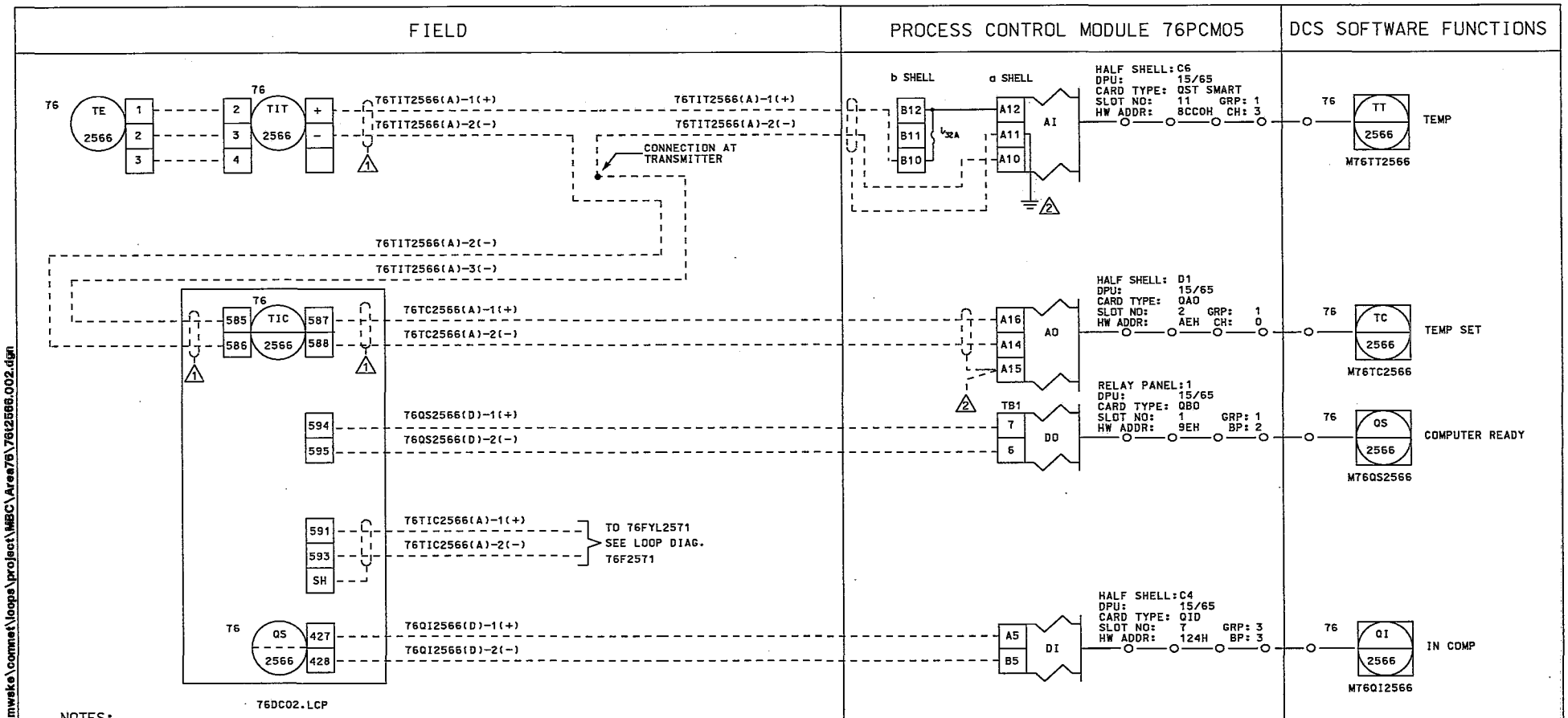

NOTES:

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
P&ID DRAWING NO. 76-I-112/122
CONDUIT PLAN DWG. 76-E-101B/161
CONDUIT SCHEDULE 76-E-517 THRU 526
BROWN AUTOMATION O&M MANUAL-VOLUME 3 OF 4, SECTION 17
SHARPLES DWG. 6149.5124-7084 SH. 1-7

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals Proj Engr	Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	7/7/97	FINAL SUBMITTAL	JC	RJ		
1	6/17/98	AS BUILT	VR	RJ		
2	2/21/02	PICK UP REVIEW COMMENTS	MB			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129
PES JOB NO. 95-653
FILE: 76T2566.DGN

INSTRUMENT LOOP DIAGRAM
DC 2 INLET SLUDGE TEMP

LOOP NO.	DWG No.	SH	SH	REV
76T2566	LD-MBC-76T2566	2 OF	3	2

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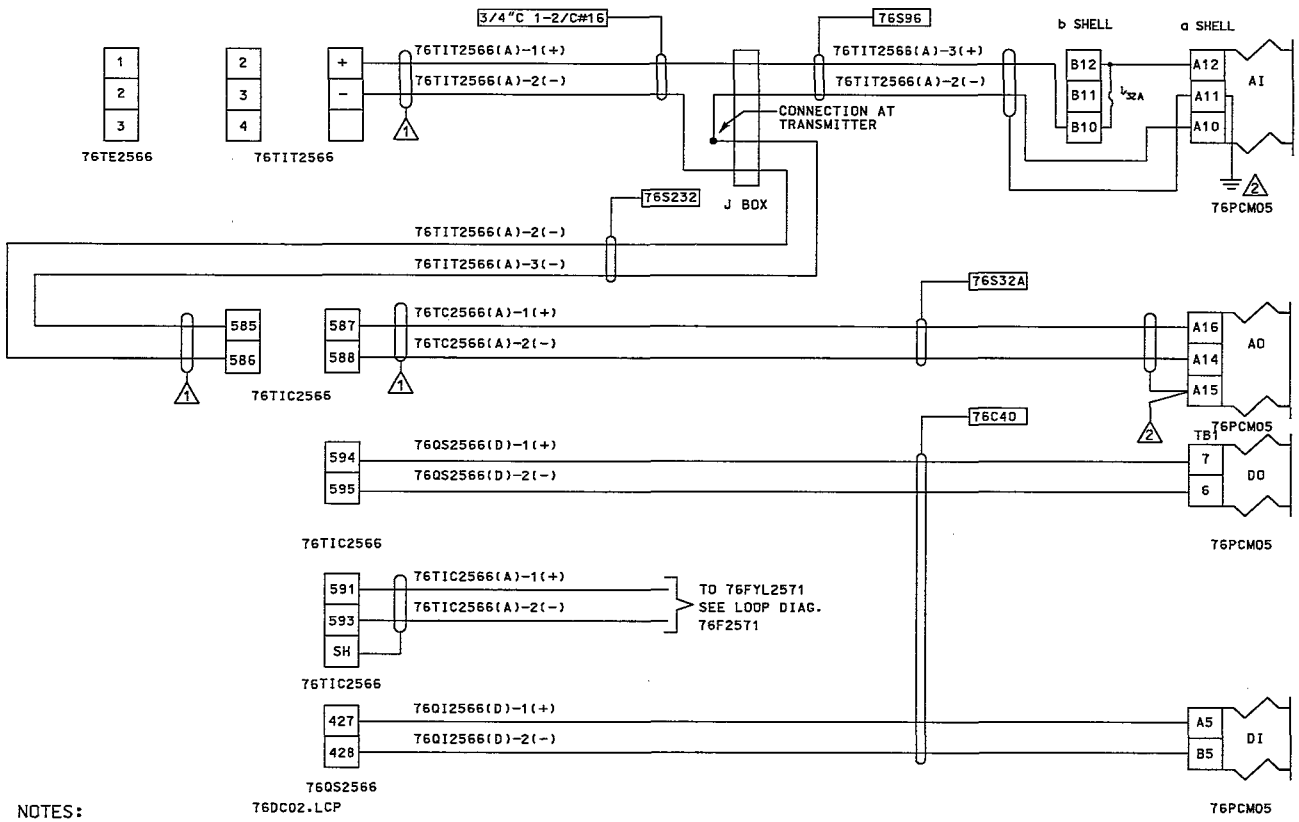

NOTES:

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
P&ID DRAWING NO. 76-I-112/122
CONDUIT PLAN DWG. 76-E-101B/161
CONDUIT SCHEDULE 76-E-517 THRU 526
BROWN AUTOMATION D&M MANUAL-VOLUME 3 OF 4, SECTION 17
SHARPLES DWG. 6149.5124-7084 SH. 1-7

Destroy all prints bearing earlier date

Rev No	Date	DESCRIPTION	By	Ckd	Approvals: Proj Engr	Approvals: Proj Mgr
A	2/18/97	INTERIM SUBMITTAL	JC	RR		
B	7/7/97	FINAL SUBMITTAL	JC	RJ		
1	6/17/98	AS BUILT	VR	RJ		
2	2/21/02	PICK UP REVIEW COMMENTS	MB			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

PACIFIC ENVIROSYSTEMS, INC.

METROPOLITAN BIOSOLIDS CENTER
METROPOLITAN WASTE WATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0129

PES JOB NO. 95-653

INTERCONNECTION DIAGRAM
DC 2 INLET SLUDGE TEMP

FILE: 76T2566.DGN

LOOP NO.	DWG No.	SH	SH	REV
76T2566	LD-MBC-76T2566	3	OF 3	2

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ATTACHMENT A-1

ALFA LAVAL SCOPE OF SUPPLY

October 8, 2012

To: Idalmiro DaRosa, Project Manager
City of San Diego
600 B St, Suite 8, San Diego, CA 92101
E-mail: IMdaRosa@sandiego.gov

Alfa Laval Inc.
5400 International Trade Drive
Richmond, VA 23231
Tel: 804-236-1352
Fax: 804-545-2030
sandip.chatterjee@alfalaval.com

Subject: MBC Dewatering Centrifuges Replacement Project, San Diego, CA
Firm Budget Proposal: Alfa Laval Dewatering Centrifuges

To Whom It May Concern:

Alfa Laval is pleased to offer this firm budget proposal for the **Alfa Laval Centrifuges** on this project. We are using the term "firm budget proposal", as the details of the final specification and scope of supply have yet to be determined.

Based on the current specification details and notations listed in our Notes of Clarification below, **Six (6) ALDEC G2-120 Centrifuges** for dewatering of the sludge will be complete and each will include the following:

- Modular Frame with Upper Casing Cover
- Upper casing (316 SS) and Lower casing (316 SS cladded)
- Rotating Assembly including Pillow Block Bearings and 30 kNm DD Gearbox
- Grease Lubricated Conveyor Bearings
- Forced Oil Lubricated Main Bearings
- 50 Hp AC VFD Premium Efficiency Back Drive motor
- 200 Hp AC VFD Premium Efficiency Main Drive motor
- NEMA 12 (**Painted Steel – 10 gauge**) Free-standing Centrifuge Control Panel
- ABB Variable Frequency Drives (ACS 800)
- Allen Bradley CompactLogix PLC
- Allen Bradley PanelView PLUS 6 HMI
- Abrasion protection with Tungsten Carbide on wear surfaces
- Power Plates
- Vibration Isolators
- Bearing Vibration Sensors
- Bearing Temperature Sensors
- Factory Paint System
- Forced Oil Lubrication Recirculation System

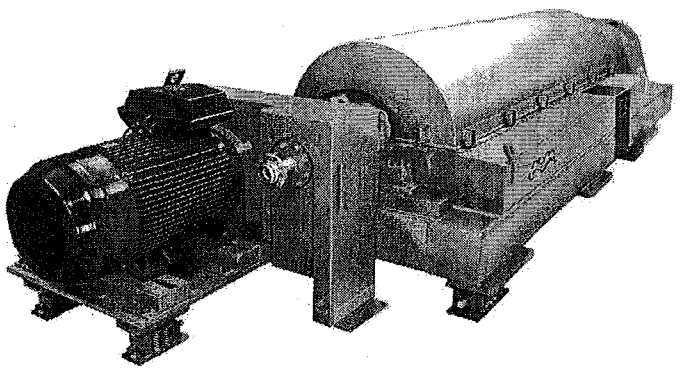
- Flexible connectors – Feed, polymer, centrate & solids
- Solids Outlet Chute (304 SS)
- Transition Centrate Funnel (304 SS)
- Centrifuge Sub base with mounting plates (Painted Steel)
- Warranty against defects in materials and workmanship for 8,760 hours or two (2) years from beneficial use, whichever occurs first
- One (1) set of required spares including o-rings & drive belts
- Thirty (30) spare tungsten carbide tiles
- One (1) set of Solids discharge port replaceable tungsten-carbide wear plates
- One (1) set of vibration and temperature sensors
- One (1) set of fasteners for inspection port, case cover and weir plates
- One (1) set of required lubricants for start-up
- Freight to job-site, DDP

Also included with pricing:

- Service Time – Ninety (90) days on-site for start-up assistance, training and testing
- Submittals w/ Drawings
- Operation and Maintenance Manuals
- One (1) set required tools for maintenance
- One (1) set of Special Tools including bowl lifter and conveyor lifter
- Standard Factory testing of centrifuges at Soborg Factory

Not included in pricing:

- Field wiring and motor flexible connections
- Piping, pipe venting, valves, meters and flow meters
- Owner's expenses for witnessing FAT
- Bowl Truck
- Feed pump
- Grinder/Macerator
- Polymer System & Polymer
- Unloading at job-site
- Anchor Bolts
- Storage and Handling Charges
- Laboratory Testing Charges
- Installation
- Taxes & Bonds



FIRM BUDGET PRICE FOR SIX (6) ALDEC G2-120 CENTRIFUGES: $_____

PRICE VALIDITY: March 31st, 2014 per Notes of Clarifications below.

DELIVERY: Submittals: Estimated 10 – 12 weeks from Receipt of Purchase Order
Centrifuge: Estimated 30 weeks from Receipt of Approved Submittals

PAYMENT TERMS:
20% with Purchase Order
10% upon Submittals, NET 30 Days
65% upon Equipment Shipment, NET 30 Days
5% upon Final Acceptance, NET 30 Days

NOTES OF CLARIFICATION:

1. Because final specifications and scope details are yet to be determined, this proposal is therefore a "firm budget proposal" and an order cannot be accepted based upon it without first receiving a final firm proposal.

2. Price validity is based on receipt of a purchase order for the first four (4) machines on or before March 31, 2013 and receipt of a purchase order for the remaining two (2) machines on or before March 31, 2014.

3. Alfa Laval has reviewed only Sections 11397, 13300 and 13400 while preparing this proposal. Other sections referred to in these sections were not available to Alfa Laval during preparation of this proposal.

4. Alfa Laval has proposed 10 gauge painted steel NEMA 12 Control Panels.

5. Warranty covers defects in materials and workmanship for 8,760 hours or twenty-four (24) months from beneficial use or for a period not to exceed thirty (30) months from shipment, whichever occurs first. Alfa Laval reserves the right to review operating and maintenance records to ensure compliance.

6. Included are service days to meet the specification requirement with the contract price. Any additional service time resulting from non-warranty delays will be charged in accordance with the field service rate schedule in effect at the time of service.

7. The process performance (cake solids, capture, polymer dosage, solids loading, hydraulic throughput, etc.) achieved by the centrifuge is dependant on sludge quality (age, grit content, etc.) and volatile solids content.

8. Alfa Laval will provide anchor bolt sizing. Anchor bolts are to be provided and installed by the installing contractor.

9. Installing contractor is responsible for maintaining all relevant electrical codes.

10. Anything not explicitly stated in this proposal is not included.

If you have any questions or require any additional information, please contact our Regional Manager, Rob Islander at (714) 287 – 0267 or our local representative, Jeremy Neill with The Coombs Hopkins Company at (760) 931 - 0555.

Sincerely,

Sandip Chatterjee

Sandip Chatterjee
Sales and Applications Engineer, PTD
Environmental Market Unit
(804)-236-1352
(804)-399-5786
(804)-545-2030
sandip.chatterjee@alfalaval.com

Cc: Rob Islander, AL
Marty Davidson, AL
Jeremy Neill, CHC

ATTACHMENT B

PROPOSAL SUBMITTAL REQUIREMENTS AND SELECTION CRITERIA

PROPOSAL SUBMITTAL REQUIREMENTS AND SELECTION CRITERIA

ENGINEERING & CAPITAL PROJECTS DEPARTMENT

Proposals submitted in response to this RFP shall be in the following order and shall include:

1. Addenda to this RFP **(PASS/FAIL)**

   Design-Builder shall confirm in its Technical Proposal the receipt of all addenda issued to this RFP. Failure to acknowledge all addenda issued, will result in the Proposal being considered non-responsive and ineligible for further consideration.

   Design-Builders are not required to include copies of the actual addenda in its Proposal.

2. Exceptions to this RFP **(PASS/FAIL)**

   If the Design-Builder takes exception(s) to any portion of the RFP and its attachments, the specific portion of the RFP or attachment to which exception is taken shall be identified and explained to the City in writing a minimum of 10 days prior to the date established for submittal of the Technical Proposal. Exceptions taken after the stipulated period to this RFP may be cause for rejection of the Proposal and discontinue the Design-Builders participation to this selection process. The City reserves the right to waive exception(s) as it deems in the best interests of the City.

4. Executive Summary **(5 Points Max)**

   Include a one- to two-page overview of the entire Proposal describing the highlights of the Proposal. Failure to provide the executive summary will result in the RFP being considered non-responsive and ineligible for further consideration.

5. Project Team **(5 Points Max)**

   Describe the proposed management plan for this project. Describe the strength of key proposed construction and technical personnel, Subcontractors, and Subconsultants, including, but not limited to the following disciplines:

   a. Civil
   b. Architectural
   c. Structural
   d. Mechanical
   e. Electrical
   g. Instrumentation and Controls
   h. Environmental
   j. Geotechnical
   k Corrosion

6. Technical Approach and Design Concept **(30 Points Max)**

Describe in detail the proposed design concept for this project. Include detailed descriptions, conceptual design drawings, schematics, a list of major equipment, and any other information deemed necessary to allow the City to make an informed evaluation of the Design-Builder's technical approach. The completeness and technical merit of the design concept will be evaluated. The following elements shall be included in this Technical Proposal:

6. Construction Plan **(25 Points Max)**

a. Describe the proposed construction plan for this project, including the following, at a minimum:

- Construction approach and methods
- Plan for operation of facility during construction
- Plan for phasing of construction activities
- General plan for functional testing and start-up.
- Proposed safety program
- Proposed construction schedule

7. Presentation and Interview **(10 Points Max)**

8. Reference Checks **(5 Points Max)**

Total Points: 100

Proposals that do not contain the aforementioned components will not be considered.

ATTACHMENT C
CONTRACT FRONT END VOLUME 1

City of San Diego

CONTRACTOR'S NAME:_____
ADDRESS:_____
TELEPHONE NO.:_____ FAX NO.:_____
CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

CONTRACT DOCUMENTS

FOR

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

VOLUME 1 OF 2

BID NO.:	**K-13-5573-DB2-3**
SAP NO. (WBS/IO/CC):	**S-00339**
CLIENT DEPARTMENT:	**2011**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BO**

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- PHASED FUNDING
- FEDERAL EQUAL OPPORTUNITY CONTRACTING REQUIREMENTS.
- PREVAILING WAGE RATES: **STATE, FEDERAL OR BOTH**
- THIS IS A CLEAN WATER STATE REVOLVING FUNDED CONTRACT THROUGH THE CALIFORNIA STATE DEPARTMENT.

((((((((((((((((ATTENTION)))))))))))))))

The 2010 edition of the City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK") now contains the following distinct Contract Documents:

i. ***Equal Opportunity Contracting Program Requirements*** - This Contract Document sets forth the standard requirements for the City's equal opportunity contracting program. When additional requirements by the funding source e.g., federal or state agencies are physically included in the contract documents or by reference and there is a discrepancy, the funding source requirements shall govern unless specified otherwise in the Special Provisions.

ii. ***City Supplement*** – The City Supplement shall be used in conjunction with the Standard Specifications for Public Works Construction ("The GREENBOOK"), 2009 Edition. The specifications contained in City Supplement take precedence over the specifications contained in The GREENBOOK, 2009 Edition.

Certain parts of the City Supplement have been highlighted in yellow for the convenience of the users only and shall not affect the interpretation of the Contract.

To obtain The GREENBOOK contact the publisher at: http://www.bnibooks.com

The WHITEBOOK is available only in electronic format under Engineering Documents and References at: http://www.sandiego.gov/engineering-cip/

REQUIRED DOCUMENTS SCHEDULE

This table is intended to serve as a convenient tool for listing forms and documents required at different times. It is neither exhaustive nor must be considered a Contract Document by itself. Therefore, the users must review the entire Contract Documents and become familiar with the required documentation and the submittal schedule associated with each document.

Bidder's attention is directed to the City's Municipal Code §22.0807(e), (3)-(5) for important information regarding required documentation.

The specified EOC forms are all available for download from the EOC Program's web site at:

http://www.sandiego.gov/eoc/forms/index.shtml

ITEM	WHEN	BY	WHAT	FORMS ARE DUE WITH:	
				TECHNICAL PROPOSAL	PRICE PROPOSAL
1.	BID DUE DATE/TIME	ALL BIDDERS	Price Proposal Form		√
2.	BID DUE DATE/TIME	ALL BIDDERS	Non-collusion Affidavit to be Executed By Bidder and Submitted with Bid under 23 USC 112 and PCC 7106		√
3.	BID DUE DATE/TIME	ALL BIDDERS	Contractors Certification of Pending Actions		√
4.	BID DUE DATE/TIME	ALL BIDDERS	Equal Benefits Ordinance Certification of Compliance		√
5.	BID DUE DATE/TIME	ALL BIDDERS	Non-Lobbying Certification		√
6.	BID DUE DATE/TIME	ALL BIDDERS	Lobby Prohibition, Certification and Disclosure		√
7.	BID DUE DATE/TIME	ALL BIDDERS	Instructions for Completion of SF-LLL, Disclosure of Lobbying Activities		√
8.	BID DUE DATE/TIME	ALL BIDDERS	Disclosure of Lobbying Activities		√
9.	BID DUE DATE/TIME	ALL BIDDERS	Form AA05 – Design-Build List of Subcontractors		√
10.	BID DUE DATE/TIME	ALL BIDDERS	Form AA10 - Design-Build List of Subcontractors Additive/Deductive Alternate		√
11.	BID DUE DATE/TIME	ALL BIDDERS	Form AA15 - Design-Build List of Subcontractors	√	
12.	BID DUE DATE/TIME	ALL BIDDERS	Form AA25 - Design-Build Named Equipment/Material Supplier List		√

REQUIRED DOCUMENTS SCHEDULE

ITEM	WHEN	BY	WHAT	FORMS ARE DUE WITH:	
				TECHNICAL PROPOSAL	PRICE PROPOSAL
13.	BID DUE DATE/TIME	ALL BIDDERS	Form AA30 - Design-Build Named Equipment/Material Supplier List	√	
14.	BID DUE DATE/TIME	ALL BIDDERS	Form AA31 - Design-Build Named Equipment/Material Supplier Additive/Deductive Alternate	√	
15.	BID DUE DATE/TIME	ALL BIDDERS	EPA FORM 6100-3 – DBE Subcontractor Performance Form	√	
16.	BID DUE DATE/TIME	ALL BIDDERS	EPA FORM 6100-4 – DBE Subcontractor Utilization Form	√	
17.	WITHIN 4 WORKING DAYS OF BID OPENING	ALL BIDDERS	Federal Good Faith Documentations	√ (if submitted with the Proposal)	
18.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	Proof of Valid DBE-MBE-WBE-DVBE Certification Status e.g., Certs.	√ (if submitted with the Proposal)	
19.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	Form AA61 – List of Work Made Available	√ (if submitted with the Proposal)	
20.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 1 - Good Faith Effort List of Subcontractors Solicited	√ (if submitted with the Proposal)	
21.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 2 - Good Faith Effort Bids Received List	√ (if submitted with the Proposal)	
22.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 3 - DBE Contractor Certification	√ (if submitted with the Proposal)	
23.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 4: - Prime Contractor/Recipient Selected DBEs	√ (if submitted with the Proposal)	
24.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 5: - Summary of Bids Received from Subcontractors	√ (if submitted with the Proposal)	

REQUIRED DOCUMENTS SCHEDULE

ITEM	WHEN	BY	WHAT	FORMS ARE DUE WITH:	
				TECHNICAL PROPOSAL	PRICE PROPOSAL
25.	WITHIN 4 WORKING DAYS OF PUBLIC RANKING MEETING	ALL BIDDERS	CWSRF Form 5: - Summary of Bids Received from Subcontractors	√ (if submitted with the Proposal)	
26.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Names of the principle individual owners of the Apparent Low Bidder - In the event the firm is employee owned or publicly held, then the fact should be stated and the names of the firm's principals and officers shall be provided.		
27.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	If the Contractor is a Joint Venture, the following information must be submitted: • Joint Venture Agreement • Joint Venture License		
28.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contract Forms - Agreement		
29.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contract Forms – Performance Bonds and Labor and Materialmen's Bond		
30.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Certificates of Insurance and Endorsements		
31.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractor Certification - Drug-Free Workplace		
32.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractor Certification - American with Disabilities Act		
33.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractors Standards - Pledge of Compliance		

REQUIRED DOCUMENTS SCHEDULE

ITEM	WHEN	BY	WHAT	FORMS ARE DUE WITH:	
				TECHNICAL PROPOSAL	PRICE PROPOSAL
34.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Phased Funding Schedule Agreement (when required)		
35.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Pre-Award Schedule (Phased Funded Contracts Only)		
36.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Form BB05 – Work Force Report		
37.	BY 5th OF EACH MONTH	CONTRACTOR	CC20 - Monthly Employment Report		
38.	BY 5th OF EACH MONTH	CONTRACTOR	CC25 - Monthly Invoicing Report		
39.	SEMI-ANNUALLY: • APRIL 30th • SEPTEMBER 30th	CONTRACTOR	EPA Form 5700-52A		
40.	PRIOR TO ACCEPTANCE	CONTRACTOR	CC10 - Contract Change Order (CCO)		
41.	PRIOR TO ACCEPTANCE	CONTRACTOR	CC15 - Final Summary Report		
42.	PRIOR TO ACCEPTANCE	CONTRACTOR	Affidavit of Disposal		

SPECIAL NOTICE
DISADVANTAGED BUSINESS ENTERPRISES (DBE)

1. INTRODUCTION. The City affirms that in any contract entered into pursuant to this advertisement, DBE will be afforded full opportunity to submit Bids in response to this invitation.

1.1. This Federally assisted project includes subcontracting participation percentages for DBE participation. DBE goal commitments and Good Faith Efforts (GFE) shall be made prior to bidding. DBE commitments and GFE made after the Bid opening will not be considered for the Award of Contract.

1.2. The Design-Builder's attention is directed to the following:

1. City of San Diego's General Equal Opportunity Contracting Program incorporated in the "WHITEBOOK" which applies to all construction contracts except as amended in these specifications and specified in the "FUNDING AGENCY PROVISIONS" incorporated in the Contract Documents.
2. Required Documents Schedule for submittals.

2. AMENDMENTS TO THE CITY'S STANDARD EOCP REQUIREMENTS.

III. Equal Employment Opportunity Outreach Program (A). DELETE in its entirety and SUBSTITUTE with the following:

A. Competitive Bids. If a contract is competitively solicited, the Apparent Low Bidder shall submit a *Work Force Report (Form BB05)* or an Equal Employment Opportunity (EEO) Plan, 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.

IX. Definitions. ADD the following for the purpose of these specifications:

Disadvantaged Business Enterprises (DBEs) are:

A. Entities owned and/or controlled by a socially and economically disadvantaged individuals as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note) (10% statute), and Public Law 102-389 (42 U.S.C. 4370d) (8% statute), respectively

B. Historically Underutilized Business (HUB) Zone Small Business Concern (or a concern under a successor program)

C. Small Disadvantaged Business (SDB)

D. Women-Owned Business (WoSB)

E. Service Disabled Veteran-owned Small Business (SDVoSB)

For the purpose of these requirements terms "Bid" and "Proposal," "Bidder" and "Proposer," "Subcontractor" and "Subconsultant," "Contractor" and "Consultant," "Contractor" and "Prime Contractor," "Consultant" and "Professional Service Provider," "Suppliers" and "Vendors," "Suppliers" and Dealers," and "Suppliers" and "Manufacturers" may have been used interchangeably.

ADD:

XIII. Federal Equal Opportunity Requirements. All federally funded projects are subject to the federal equal opportunity regulations and the following requirements. The City reserves the right to audit Contractor's compliance with the federal requirements set forth below.

3. SUBCONTRACTING PARTICIPATION PERCENTAGES. Following are federally subcontracting participation percentages for this contract. For the purpose of achieving the subcontractor participation percentage, Additive or Deductive, and Allowance Bid Items will not be included in the calculation.

3.1. Environmental Protection Agency (EPA) - In accordance with EPA's Program for Utilization of Small, Minority Disadvantaged and Women Business Enterprises in procurement under Federal assistance programs, the Contractor agrees to the applicable "fair share" objectives negotiated with EPA as follows:

California State Water Resources Control Board - Clean Water State Revolving Fund (CWSRF):

		MBE*	WBE*
1.	Construction	24%	6%
2.	Supplies	29%	20%
3.	Services	30%	31%
4.	Equipment (combined in above)	17%	9%

Note: MBEs and WBEs must be certified by EPA, SBA, DOT or by state, local, Tribal, or private entities whose certification criteria match EPAs in order to be counted toward MBE/WBE accomplishments. MBEs and WBEs are a part of the larger universe of DBEs.

4. PRE-PROPOSAL MEETING. A mandatory Pre- Proposal Meeting is scheduled for this project as specified in Section 9.2 of the RFP. The purpose of this meeting is to inform prospective Design-Builder(s) of the submittal requirements and provisions relative to the City requirements.

5. MANDATORY CONDITIONS. Bid will be declared **non-responsive** if the Design-Builder fails any of the following conditions:

5.1. Submission of GFE documentation, as specified in the Special Provisions.

5.2. Attending the Pre-Proposal Meeting.

5.3. Bidder's submission of GFE documentation demonstrating the Bidder made a good faith effort to outreach to and include DBE Subcontractors shall be submitted within **4 Working Days** of the Bid opening.

CITY OF SAN DIEGO, CALIFORNIA

INVITATION TO BIDS

1. **DESCRIPTION OF WORK:** The Work involves furnishing all labor, materials, equipment, services, and other incidental works and appurtenances for the design and construction of the Project as described in the RFP.

    - Design-Build Bridging Documents included as attachment to the RFP.

        1. **See Attachment A.**

2. **CONTRACT TIME:** The Contract Time for completion of the Work shall be **1,643 Calendar Days.**

3. **SUPPLEMENTAL AGREEMENTS:** Supplemental agreements attached to this contract for the items of Work such as extended re-vegetation maintenance and monitoring and emulsion aggregate slurry shall be signed upon the request from the Engineer and prior to Acceptance. The signed agreements shall be accompanied by the evidence of separate bond (i.e., labor and materials) and insurance (i.e., Commercial General Liability Insurance, Commercial Automobile Liability Insurance, and Workers' Compensation Insurance) as specified in 2-4, "CONTRACT BONDS," 7-3, "LIABILITY INSURANCE," and 7-4 WORKERS' COMPENSATION INSURANCE. Bonds shall be in amount of the Contract Price for the Work included in the supplemental agreements.

4. **WAGE RATES:** Prevailing wages are not applicable to this project unless specified otherwise on the cover page of these specifications and when included in these specifications. See Funding Agency Provisions that follow this Invitation to Bid for more information.

5. **INSURANCE REQUIREMENTS:** Upon receipt of the City's Notice of Intent to Award letter, the Contractor will be asked to submit all certificates of insurance and endorsements to the City.

    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.

    You must ensure all required insurance certificates and endorsements are submitted accurately and on time. Failure to provide the requisite insurance documents by the date stated in the City's Notice of Intent to Award will result in delay of contract award and may result in annulment of the contract award or other more severe sanctions as provided in the City's Municipal Code §22.0807(e),(3)-(5).

6. **PHASED FUNDING:** The Apparent Low Bidder will be required to provide a Pre-award Schedule in accordance with sections 9-3 and 6-1 of the Supplementary Special Provisions (SSP) prior to award of Contract.

Tony Heinrichs, Director
Public Works Department

INSTRUCTIONS TO BIDDERS

1. **PREQUALIFICATION OF CONTRACTORS:** The contractor(s) who intend to submit Bid or Proposal in response to this invitation to bid, or RFP's for GRC or As-Needed Design-Build Task Orders valued over $50,000, must be pre-qualified for total amount proposed, inclusive of all alternate bid items or the specified Task Order limits prior to the date of Proposal.

   For Design-Build As-Needed contracts, if the total active work issued would limit the RFP for a new Task Order authorization to only 1 eligible firm of the short-listed firms, thus creating a non-competitive situation, that Task Order authorization(s) will be held until enough active work is deemed by the City to be completed and closed, thereby creating available eligibility for competition, or the City at its sole discretion can advertize a new open RFP for the needed project requirement.

   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, will be deemed **non-responsive** and ineligible for award or a Task Order authorization. Complete information and prequalification questionnaires are available at:

   http://www.sandiego.gov/engineering-cip/services/consultcontract/prequal.shtml

   The completed questionnaire, financial statement, and bond letter or a copy of the contractor's SLBE-ELBE certification and bond letter, must be submitted no later than 2 weeks prior to the bid opening to the Public Works Department - Engineering & Capital Project, Prequalification Program, 1010 Second Avenue, Suite 1200, San Diego, CA 92101. For additional information or the answer to questions about the prequalification program, please contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.

2. **CONTRACTOR REGISTRATION:** Prospective bidder(s) as well as existing contractors and suppliers are required to register with the City's EOCP. Refer to 2-17, "CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM" for details.

3. **CITY'S RESPONSES AND ADDENDA:** The City at its option, may respond to any or all questions submitted in writing, via letter, or FAX in the form of an addendum. No oral comment 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 on the form provided for this purpose in the Bid.

4. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Invitation to 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 Invitation to Bid shall be the sole responsibility of each bidder. The Invitation to Bid creates or imposes no obligation upon the City to enter a contract.

5. **CONTRACT PRICING FORMAT:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth in the Bid Proposal Form(s), Volume 2 unless specified otherwise such as as-needed contracts e.g., GRC in the Contract Documents.

6. **SUBMITTAL OF "OR EQUAL" ITEMS:** See 4-1.6, "Trade Names or Equals."

7. **AWARD PROCESS:** The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award, including the submittal of acceptable insurance and surety bonds pursuant to San Diego Municipal Code § 22.3007.

   If the responsible Bid does not exceed the City's engineering estimate, the City will, in most cases, prepare contract documents for execution within 3 weeks of the date of the Bid opening and award the Contract within 5 Working Days of receipt of properly executed Contract, bond, and insurance documents.

   This contract is deemed to be awarded, and effective, only upon the signing of the Contract by the Mayor or designee of the City.

8. **SUBCONTRACT LIMITATIONS:** The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" which requires the Contractor to perform not less than the amount therein stipulated with its own forces. Failure to comply with these requirements may render the Bid **non-responsive** and ineligible for award.

9. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: http://www.sandiego.gov/engineering-cip. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracting Group.

10. **QUESTIONS:** 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 procurement action shall be addressed to the Public Works Contracting Group, Attention Contract Specialist, 1010 Second Avenue Suite 1400 MS 614C, San Diego, California, 92101, Telephone No. (619) 533-3450.

    Questions received less than 14 days prior to the date for opening of Bids may not be answered.

    Interpretations or clarifications considered necessary by the City in response to such questions will be issued by Addenda which will be uploaded to the City's online bidding service.

    Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarifications will 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.

11. **ELIGIBLE BIDDERS:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than 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.

12. **SAN DIEGO BUSINESS TAX CERTIFICATE:** All Contractors, including 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, before the Contract can be executed.

13. **PROPOSAL FORMS:** Bid shall be made only upon the Proposal Documents i.e., Proposal form attached to and forming a part of the specifications. The signature of each person signing shall be in longhand.

The entire specifications for the bid package do not need to be submitted with the bid. Bidder shall complete and submit, only, all pages in the "Proposal Documents" Section (see Volume 2) as their Bid per the schedule given under "Required Documents Schedule," (see Volume 1). Bidder is requested to retain for their reference other portions of the Contract Documents that are not required to be submitted with the Bid.

The City may require any Bidder to furnish a statement of experience, financial responsibility, technical ability, equipment, and references.

Bids and certain other specified forms and documents shall be enclosed in a sealed envelope and shall bear the title of the work and name of the Bidder and the appropriate State Contractors License designation which the Bidder holds.

Bids may be withdrawn by the Bidder prior to, but not after, the time fixed for opening of Bids.

14. **BIDDERS' GUARANTEE OF GOOD FAITH (BID SECURITY):** With the exception of the contracts valued $5,000 or less, GRC and Design-Build contracts, and contracts subject to the Small and Local Business Program of $250,000 or less e.g., ELBE contracts, each Bidder shall accompany its Bid with either a cashier's check upon some responsible bank, or a check upon such bank properly certified or an approved corporate surety bond payable to the City of San Diego, for an amount of not less than 10% of the aggregate sum of the Bid, which check or bond, and the monies represented thereby shall be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into such contract and furnish the required final bonds.

The Bidder agrees that in case of Bidder's refusal or failure to execute this contract and give required final bonds, the money represented by a cashier's or certified check shall remain the property of the City, and if the Bidder shall fail to execute this contract, the Surety agrees that it will pay to the City damages which the City may suffer by reason of such failure, not exceeding the sum of 10% of the amount of the Bid.

A Bid received without the specified bid security will be rejected as being **non-responsive.**

15. **AWARD OF CONTRACT OR REJECTION OF BIDS:** This contract may be awarded to the lowest responsible and reliable Bidder (for Design-Build contracts refer to the RFP for the selection and award information). Bidders shall complete the entire Bid schedule (e.g., schedule of prices). Incomplete price schedules will be rejected as being **non-responsive.**

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.

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.

A non-selected Bidder may protest award of the Contract to the selected Bidder by submitting a written "Notice of Intent to Protest" including supporting documentation which shall be received by Public Works Contracting Group no later than 10 days after the City's announcement of the selected Bidder or no later than 10 days from the date that the City issues notice of designation of a Bidder as non-responsible in accordance with San Diego Municipal Code Chapter 2, § 22.3029, "Protests of Contract Award."

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.

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 Invitation to Bids.

The City reserves the right to evaluate all Bids and determine the lowest Bidder (or winner for Design-Build contracts) on the basis of any proposed alternates, additive items or options, at its discretion.

16. **BID RESULTS:** The Bid opening by the City shall constitute the public announcement of the Apparent Low Bidder (or Apparent Winner in case of Design-Build contracts). In the event that the Apparent Low Bidder (or Apparent Winner in case of Design-Build contracts) is subsequently deemed non-responsive or non-responsible, a public announcement will be posted in the City's web page, with the name of the newly designated Apparent Low Bidder (or Apparent Winner in case of Design-Build contracts).

To obtain Bid results, either attend Bid opening, review the results on the City's web site, or provide a self-addressed, stamped envelope, referencing Bid number, and Bid tabulation will be mailed to you upon verification of extensions. Due to time constraints, Bid results cannot be given out over the telephone.

17. **THE CONTRACT:** 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 10 Working Days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

If the Bidder takes longer than 10 Working 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.

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.

For contracts that are not Design-Build, 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 10 Working 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.

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. 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.

18. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, the GRC Unit Price Books if applicable, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Proposal Documents) therefore. The submission of a Bid or GRC Task Order Proposal 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 Proposal Documents Proposal, Plans, and Specifications.

19. **DRUG-FREE WORKPLACE:**

a) General:

City projects are subject to City of San Diego Resolution No. R-277952 adopted on May 20, 1991. Bidders shall become aware of the provisions of Council Policy 100-17 which was established by Resolution No. R-277952. The policy applies equally to the Contractor and Subcontractors. The elements of the policy are outlined below.

b) Definitions:

"Drug-free workplace" means a site for the performance of work done in connection with a contract let by City of San Diego for the construction, maintenance, or repair of any facility or public work by an entity at which employees of the entity are prohibited from engaging in the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance in accordance with the requirements of this section.

"Employee" means the employee of a contractor directly engaged in the performance of work pursuant to a contract as described in Section 3, "City Contractor Requirements."

"Controlled substance" means a controlled substance in schedules I through V of Section 202 of the Controlled Substances Act (21 U.S.C. Sec. 812).

"Contractor" means the department, division, or other unit of a person or organization responsible to the contractor for the performance of a portion of the work under the contract.

c) City Contractor Requirements:

Every person or organization awarded a contract or grant by the City of San Diego for the provision of services shall certify to the City that it will provide a drug-free workplace by doing all following:

a. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited in the person's organization's workplace and specifying the actions that will be taken against employees for violations of the prohibition.

b. Establishing a drug-free awareness program to inform employees about all of the following:

i. The dangers of drug abuse in the workplace.

ii. The person's or organization's policy of maintaining a drug-free workplace.

iii. Any available drug counseling, rehabilitation, and employee assistance programs.

iv. The penalties that may be imposed upon employees for drug abuse violations.

c. Posting the statement required by subdivision (1) in a prominent place at contractor's main office. For projects large enough to necessitate a construction trailer at the job site, the required signage would also be posted at the Site.

The Contractor shall include in each subcontract agreement language which indicates the Subcontractor's agreement to abide by the provisions of subdivisions a) through c) above. The Contractors and Subcontractors shall be individually responsible for their own drug-free workplace programs.

Note: The requirements of a drug-free awareness program can be satisfied by periodic tailgate sessions covering the various aspects of drug-abuse education. Although an in-house employee assistance program is not required, contractors should be able to provide a listing of drug rehabilitation and counseling programs available in the community at large.

Questions about the City's Drug-free Workplace Policy shall be referred to the Contract Specialist, Public Works Contracting Group.

20. AMERICANS WITH DISABILITIES ACT:

a) General: City projects are subject to City of San Diego Resolution No. R-282153 adopted on June 14, 1993. The Bidders shall become aware of the provisions of Council Policy 100-04 which was established by Resolution No. R-282153. The policy applies equally to the Contractor and all Subcontractors. The elements of the policy are outlined below.

b) Definitions:

"Qualified individual with a disability" means an individual with a disability who satisfies the requisite skill, experience, education and other job-related requirements of the employment position such individual holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

"Employee" means the employee of the Contractor directly engaged in the performance of Work.

c) The City Requirements: Every person or organization entering into a contractual agreement with or receiving a grant from the City of San Diego shall certify to the City of San Diego that it will comply with the ADA by adhering to all of the provisions of the ADA listed below.

i. The Contractor shall not discriminate against qualified persons with disabilities in any aspects of employment, including recruitment, hiring, promotions, conditions and privileges of employment, training, compensation, benefits, discipline, layoffs, and termination of employment.

ii. No qualified individual with a disability may be excluded on the basis of disability, from participation in, or be denied the benefits of services, programs, or activities by the Contractor or Subcontractors providing services for the City.

iii. The Contractor shall post a statement addressing the requirements of the ADA in a prominent place at the worksite. The Contractor shall include in each subcontract agreement, language which indicates the Subcontractor's agreement to abide by the provisions of subdivisions (a) through (c) inclusive of Section 3. The Contractor and Subcontractors shall be individually responsible for their own ADA employment programs. Questions about the City's ADA Policy should be referred to the Contract Administrator.

21. **CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE:** This contract is subject to City of San Diego Municipal Code §22.3224 as amended 11/24/08 by ordinance O-19808. Bidders shall become aware that the requirements apply to Contractors and Subcontractors for contracts greater than $50,000 in value.

Upon award, amendment, renewal, or extension of this contract, the Contractors shall complete a Pledge of Compliance attesting under penalty of perjury that they complied with the requirements of this section.

The Contractors shall ensure that their Subcontractors whose subcontracts are greater than $50,000 in value complete a Pledge of Compliance attesting under penalty of perjury that they complied with the requirements of this section. Subcontractors may access the Pledge of Compliance at:

http://www.sandiego.gov/purchasing/pdf/contractor_standards_questionnaire.pdf.

The Contractors shall include in each subcontract agreement, language which requires Subcontractors to abide by the provisions of City of San Diego Municipal Code §22.3224. A sample provision is as follows:

> "**Compliance with San Diego Municipal Code §22.3224**: Subcontractor acknowledges that it is familiar with the requirements of San Diego Municipal Code §22.3224 ("Contractor Standards"), and agrees to comply with requirements of that section. The Subcontractor further agrees to complete the Pledge of Compliance, incorporated herein by reference."

22. **NOTICE OF LABOR COMPLIANCE PROGRAM APPROVAL:** The City of San Diego received initial approval as a Labor Compliance Program on August 11, 2003. The Labor Compliance Program Manual is available at:

http://www.sandiego.gov/eoc/laborcompliance/#manual.

The limited exemption from prevailing wages pursuant to Labor Code §1771.5(a) does not apply to contracts under jurisdiction of the Labor Compliance Program. Inquiries, questions, or assistance about the Labor Compliance Program should be directed to: Equal Opportunity Contracting Program, 1010 Second Avenue Suite 1400, MS 614C, San Diego, CA 92101, Tel. 619-533-3450.

23. **PAYROLL RECORDS:** The Contractor's attention is directed to the City of San Diego Labor Compliance Program, Section IV, pages 4-7, and the State of California Labor Code §§ 1771.5(b) and 1776 (Stats. 1978, Ch. 1249). These require, in part, that the Contractor and Subcontractors maintain and furnish to the City, at a designated time, a certified copy of each weekly payroll containing a statement of compliance signed under penalty of perjury.

The Contractor and Subcontractors shall submit weekly certified payrolls online via Prism® i.e., the City's web-based labor compliance program. Instructions on how to use the system will be provided to the Contractor after the award.

The Contractor shall be responsible for the compliance with these provisions by Subcontractors. The City shall withhold contract payments when payroll records are delinquent or inadequate, or when it is established after investigation that underpayment has occurred.

24. **APPRENTICES ON PUBLIC WORKS:** The Contractor shall abide by the requirements of §§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.

25. **EQUAL BENEFITS:** This Contract Is Subject To The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 Of The San Diego Municipal Code (SDMC).

In accordance with the EBO, Bidders shall certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the Contract (SDMC §22.4304(f)). Failure to maintain equal benefits is a material breach of the Contract (SDMC §22.4304(e)). The Contractor shall notify employees of their equal benefits policy at the time of hire and during open enrollment periods and shall post a copy of the following statement in an area frequented by employees:

> "During the performance of a contract with the City of San Diego, this employer will provide equal benefits to its employees with spouses and its employees with domestic partners."

The Contractor shall give the City access to documents and records sufficient for the City to verify the contractors are providing equal benefits and otherwise complying with EBO requirements.

Full text of the EBO and the Rules Implementing the Equal Benefits Ordinance are posted on the City's website at www.sandiego.gov/purchasing/ or can be requested from the Equal Benefits Program at (619) 533-3948.

26. **LIMITED COMPETITION:** Contracts designated with a Bid number beginning with "L" may only be bid by the Contractors on the approved SLBE-ELBE Construction Contractors List. For information regarding the SLBE-ELBE Construction Program and registration go to the City's web site: http://www.sandiego.gov.

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

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

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

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

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

27.5. 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.

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

27.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

28. PRE-AWARD ACTIVITIES:

Pre-award Submittals - The Apparent Low Bidder (or winner in case of Design-Build contracts) shall provide the information required within the time specified in "Required Documents," of this bid package. Failure to provide the information within the time specified may result in the Bid being rejected as **non-responsive.**

If the Bid is rejected as non-responsive, the Apparent Low Bidder (or winner in case of Design-Build contracts) shall forfeit the Bid Security required under Invitation to Bids, of this bid package. The decision that the Apparent Low Bidder (or winner in case of Design-Build contracts) is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

Pre-award Schedule and Phased Funding - For phased funded contracts, One of the Pre-award Submittals is the Pre-award Schedule which is a cost loaded CPM schedule prepared in accordance with section 6-1.1, "Construction Schedule." The Apparent Low Bidder (or the apparent winner in case of Design-Build contracts) shall review subsection 6-1.4, "Phased Funding" and submit the required information as specified.

FUNDING AGENCY PROVISIONS

IN THE EVENT THAT THESE REQUIREMENTS CONFLICT WITH THE CITY'S GENERAL EOC REQUIREMENTS, THE FUNDING AGENCY'S REQUIREMENTS WILL CONTROL.

1. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246).

1.1. The goal and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, as follows:

		Goal
1.	Minority Participation:	16.9%
2.	Female Participation:	6.9%

1.2. These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs Work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the Work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both federally involved and non-federally involved Work.

1.3. The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals.

1.4. The hours of minority and female employment and training shall be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

1.5. The Contractor shall provide written notification to the Director the Office of Federal Contract Compliance Programs within 10 Working Days of award of any Subcontract in excess of $10,000 at any tier for Work under the Contract resulting from this solicitation. The notification shall list the name, address and telephone number of the Subcontractor; employer identification number of the Subcontractor; estimated dollar amount of the Subcontract; estimated starting and completion dates of the Subcontract; and the geographical area in which the subcontract is to be performed. The "covered area" is the City of San Diego.

2. NONDISCRIMINATION PROVISIONS FOR FEDERALLY ASSISTED CONSTRUCTION CONTRACTS AND PROJECTS:

2.1. During the performance of this contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but shall not be

limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The Contractor will, in all solicitations or advertisements for employees placed by, on behalf of, the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. The Contractor will send to each labor union or representative of worker with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advertising the said labor union or workers' representatives of the Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, or of the rules, regulations and relevant orders of the Secretary of Labor.

5. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

6. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The Contractor will include the portion of the sentence immediately preceding Paragraph 1 and the provisions of Paragraphs 1 through 7 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or Vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or Vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

3. EQUAL OPPORTUNITY CLAUSES:

3.1. The following equal opportunity clauses are incorporated by reference herein:

1. The equal opportunity clause located 41 CFR 60.1.4(a), which specifies the obligations imposed under Executive Order 11246.
2. The equal opportunity clause located at 41 CFR 60-741.5, which contains the obligations imposed by Section 503 of the Rehabilitation Act of 1973.
3. The "Equal Opportunity Clause" (Resolution No. 765092) filed on December 4, 1978, in the Office of the City Clerk, San Diego, California and incorporated in the "Standard Federal Employment Opportunity Construction Contract Specifications (Executive Order 11246 - Document No. 769023, filed September 11, 1984, in the Office of the City Clerk, San Diego, California) is applicable to all non-exempt City construction contracts and subcontracts of $2,000 or more.
4. Age Discrimination Act of 1975, Pub. L. 94-135.
5. Title VI of the Civil Rights Act of 1964, Pub. L. 88-352.
6. Section 13 of the Federal Water Pollution Control Acts Amendments of 1972, Pub. L. 92-5200 (the Clean Water Act).
7. Section 504 of the Rehabilitation Act of 1973, Pub. L. 93-112 (Executive Orders 11914 and 11250).
8. Women's Minority Business Enterprises, Executive Orders 11625, 12138 and 12432.
9. Section 129 of the Small Business Administration Reauthorization and Amendment Act of 1988, Pub. L. 100-590.

4. STANDARD FEDERAL EQUAL EMPLOYMENT SPECIFICATIONS:

4.1. The Contractor is required to comply with the 16 "Standard Federal Equal Employment Specifications" located at 41 CFR 60-4.3 for federal and federally-assisted construction contracts in excess of $10,000, set forth below.

4.2. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions The Contractor shall document these efforts fully, and shall implement affirmative actions steps at least as extensive as the following:

1. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign 2 or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
2. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

3. Maintain a current file of the names, addresses and telephone numbers of each minority and female walk-in applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

4. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

5. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 2 above.

6. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreements; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

7. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignments, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, foreman, etc., prior to the initiation of Work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and dispositions of the subject matter.

8. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

9. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

10. Encourage present minority and female employees to recruit other minority persons and women and where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

11. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

12. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

13. Ensure that seniority practices, job classifications, work assignments and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

14. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

15. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

16. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

5. VIOLATION OR BREACH OF REQUIREMENTS:

5.1. If at any time during the course of the Contract there is a violation of the Affirmative Action or Equal Employment Opportunity requirements by the Contractor, or the Subcontractors, the City will notify the Contractor of the breach. The City may withhold any further progress payments to the Contractor until the City is satisfied that the Contractor and Subcontractors are in full compliance with these requirements.

6. MONTHLY EMPLOYMENT UTILIZATION REPORTS:

6.1. Refer to GENERAL EQUAL OPPORTUNITY CONTRACTING PROGRAM REQUIREMENTS, CONSTRUCTION CONTRACTOR REQUIREMENTS in The WHITEBOOK and the following:

1. State of California Department of Transportation Payroll Report. Due to the City weekly.

2. Federal and Non-Federal Work in San Diego County. Submit an updated list only if work is complete or new contracts have been awarded during the span of this project.

7. RECORDS OF PAYMENTS TO DBEs

7.1. The Contractor shall maintain records and documents of payments to DBEs for 3 years following the NOC. These records shall be made available for inspection upon request by any authorized representative of the City, DOT, or both. The reporting requirement shall be extended to any certified DBE Subcontractor.

8. FEDERAL WAGE REQUIREMENTS FOR FEDERALLY FUNDED PROJECTS:

8.1. The successful Bidder's work shall be required to comply with Executive Order 11246, entitled "Equal Employment Opportunity,", as amended by Executive Order 11375, and as supplemented in Department of Labor regulations (41 CFR chapter 60).

8.2. This Executive Order pertains to Equal Employment Opportunity regulations and contains significant changes to the regulations including new goals and timetables for women in construction and revised goals and time-tables for minorities in construction.

8.3. Minimum wage rates for this project have been predetermined by the Secretary of Labor and are set forth in the Decision of the Secretary and bound into the specifications book. Should there be any difference between the state or federal wage rates, including health and welfare funds for any given craft, mechanic, or similar classifications needed to execute the Work, it shall be mandatory upon the Contractor or subcontractor to pay the higher of the two rates.

8.4. The minimum wage rate to be paid by the Contractor and the Subcontractors shall be in accordance with the Federal Labor Standards Provisions (see pages **366** through **371** below) and Federal Wage Rates (see Wage Rates below) and General Prevailing Wage Determination made by the State of California, Director of Industrial Relations pursuant to California Labor Code Part 7, Chapter 1, Article 2, Sections 1770, 1773 and 1773.1, whichever is higher.

8.5. A Contractor having 50 or more employees and its Subcontractors having 50 or more employees and who may be awarded a contract of $50,000 or more will be required to maintain an affirmative action program, the standards for which are contained in the specifications.

8.6. To be eligible for award, each Bidder shall comply with the affirmative action requirements which are contained in the specifications.

8.7. Women will be afforded equal opportunity in all areas of employment. However, the employment of women shall not diminish the standards of requirements for the employment of minorities.

9. STATE REQUIREMENTS FOR CONTRACTS SUBJECT TO STATE PREVAILING WAGE REQUIREMENTS:

9.1. In accordance with the provisions of California Labor Code Sections 1770, et seq. as amended, the Director of the Department of Industrial Relations has determined the general prevailing rate of per diem wages in accordance with the standards set forth in such Sections for the locality in which the Work is to be performed. Copies of the prevailing rate of per diem wages may be found at http://www.dir.ca.gov/dlsr/statistics_research.html. The Contractor shall post a copy of the above determination of the prevailing rate of per diem wages at each job site and shall make them available to any interested party on request.

9.2. Pursuant to Sections 1720 et seq., and 1770 et seq., of the California Labor Code the Contractor any Subcontractor shall pay not less than said specified rates determined by the Director of the California Department of Industrial Relations to all workmen employed by them in the execution of the Work.

9.3. The wage rates determined by the Director of Industrial Relations and published in the Department of Transportation publication entitled, "General Prevailing Wage Rates", refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, said 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 Department of Industrial Relations, 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.

The successful bidder intending to use a craft or classification not shown on the prevailing rate determinations may be required to pay the rate of the craft or classification most closely related to it.

10. WAGE RATES. This contract shall be subject to the following Davis-Bacon Wage Decisions:

General Decision Number: CA130001 01/04/2013 CA1

Superseded General Decision Number: CA20120001

State: California

Construction Types: Building, Heavy (Heavy and Dredging), Highway and Residential

County: San Diego County in California.

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS; RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/04/2013

ASBE0005-002 06/28/2010

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems)	$ 32.79	16.31
Fire Stop Technician (Application of Firestopping Materials for wall openings and penetrations in walls, floors, ceilings and curtain walls)	$ 24.21	13.76

ASBE0005-004 06/28/2010

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)	$ 18.70	8.65

BOIL0092-003 05/01/2011

	Rates	Fringes
BOILERMAKER	$ 41.26	25.27

BRCA0004-008 11/01/2012

	Rates	Fringes
BRICKLAYER; MARBLE SETTER	$ 33.75	14.55

BRCA0018-004 06/01/2012

	Rates	Fringes
MARBLE FINISHER	$ 27.04	10.66
TILE FINISHER	$ 22.37	9.19
TILE LAYER	$ 33.55	13.55

BRCA0018-010 09/01/2009

	Rates	Fringes
TERRAZZO FINISHER	$ 26.59	9.62

TERRAZZO WORKER/SETTER.....$ 33.63 10.46

CARP0409-002 07/01/2008

	Rates	Fringes
Diver		
(1) Wet	$ 663.68	9.82
(2) Standby	$ 331.84	9.82
(3) Tender	$ 323.84	9.82
(4) Assistant Tender	$ 299.84	9.82

Amounts in "Rates' column are per day

CARP0409-008 08/01/2010

	Rates	Fringes
Modular Furniture Installer	$ 17.00	7.41

CARP0547-001 07/01/2009

	Rates	Fringes
CARPENTER		
(1) Bridge	$ 37.28	10.58
(2) Commercial Building	$ 32.30	10.58
(3) Heavy & Highway	$ 37.15	10.58
(4) Residential Carpenter	$ 25.84	10.58
(5) Residential Insulation Installer	$ 18.00	8.16
MILLWRIGHT	$ 37.65	10.58
PILEDRIVERMAN	$ 37.28	10.58

CARP0547-002 07/01/2009

	Rates	Fringes
Drywall		
(1) Work on wood framed construction of single family residences, apartments or condominiums under four stories		
Drywall Installer/Lather	$ 21.00	8.58
Drywall Stocker/Scrapper	$ 11.00	6.67
(2) All other work		
Drywall Installer/Lather	$ 27.35	9.58
Drywall Stocker/Scrapper	$ 11.00	6.67

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* ELEC0569-001 08/27/2012

	Rates	Fringes
Electricians (Tunnel Work)		
Cable Splicer	$ 43.05	3%+11.87
Electrician	$ 42.30	3%+11.87

Electricians: (All Other
Work, Including 4 Stories
Residential)

Cable Splicer	$ 38.35	3%+11.87
Electrician	$ 37.60	3%+11.87

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* ELEC0569-005 12/01/2012

	Rates	Fringes
Sound & Communications		
Sound Technician	$ 27.57	3%+10.81
Soundman	$ 22.06	3%+9.17

SOUND TECHNICIAN: Terminating, operating and performing final check-out

SOUNDMAN: Wire-pulling, splicing, assembling and installing devices

SCOPE OF WORK Assembly, installation, operation, service and maintenance of components or systems as used in closed circuit television, amplified master television distribution, CATV on private property, intercommunication, burglar alarm, fire alarm, life support and all security alarms, private and public telephone and related telephone interconnect, public address, paging, audio, language, electronic, background music system less than line voltage or any system acceptable for class two wiring for private, commercial, or industrial use furnished by leased wire, frequency modulation or other recording devices, electrical apparatus by means of which electricity is applied to the amplification, transmission, transference, recording or reproduction of voice, music, sound, impulses and video. Excluded from this Scope of Work - transmission, service and maintenance of background music. All of the above shall include the installation and transmission over fiber optics.

ELEC0569-006 12/01/2011

Work on street lighting; traffic signals; and underground systems and/or established easements outside of buildings

	Rates	Fringes
Traffic signal, street light and underground work		
Utility Technician #1	$ 27.25	3%+7.27
Utility Technician #2	$ 22.40	3%+7.27

STREET LIGHT & TRAFFIC SIGNAL WORK:

UTILITY TECHNICIAN #1: Installation of street lights and traffic signals, including electrical circuitry, programmable controller, pedestal-mounted electrical meter enclosures and laying of pre-assembled cable in ducts. The

layout of electrical systems and communication installation including proper position of trench depths, and radius at duct banks, location for manholes, street lights and traffic signals.

UTILITY TECHNICIAN #2: Distribution of material at jobsite, installation of underground ducts for electrical, telephone, cable TV land communication systems. The setting, leveling, grounding and racking of precast manholes, handholes and transformer pads.

ELEC0569-008 06/01/2011

	Rates	Fringes
ELECTRICIAN (Residential, 1-3 Stories)	$ 22.37	3%+2.90

ELEC1245-001 06/01/2012

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer	$ 48.95	14.05
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment)	$ 39.09	12.97
(3) Groundman	$ 29.91	12.70
(4) Powderman	$ 43.71	13.15

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ELEV0018-001 01/01/2012

	Rates	Fringes
ELEVATOR MECHANIC	$ 47.73	23.535

FOOTNOTE:
PAID VACATION: Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.
PAID HOLIDAYS: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0012-003 07/01/2012

	Rates	Fringes

OPERATOR: Power Equipment
(All Other Work)

GROUP 1	$ 37.40	20.00
GROUP 2	$ 38.18	20.00
GROUP 3	$ 38.47	20.00
GROUP 4	$ 39.96	20.00
GROUP 5	$ 41.06	20.00
GROUP 6	$ 40.18	20.00
GROUP 8	$ 41.39	20.00
GROUP 9	$ 40.41	20.00
GROUP 10	$ 40.41	20.00
GROUP 11	$ 40.58	20.00
GROUP 12	$ 40.58	20.00
GROUP 13	$ 40.68	20.00
GROUP 14	$ 40.71	20.00
GROUP 15	$ 40.79	20.00
GROUP 16	$ 40.91	20.00
GROUP 17	$ 41.08	20.00
GROUP 18	$ 41.18	20.00
GROUP 19	$ 41.29	20.00
GROUP 20	$ 41.41	20.00
GROUP 21	$ 41.58	20.00
GROUP 22	$ 41.68	20.00
GROUP 23	$ 41.79	20.00
GROUP 24	$ 41.91	20.00
GROUP 25	$ 42.08	20.00

OPERATOR: Power Equipment
(Cranes, Piledriving &
Hoisting)

GROUP 1	$ 38.75	20.00
GROUP 2	$ 39.53	20.00
GROUP 3	$ 39.82	20.00
GROUP 4	$ 39.96	20.00
GROUP 5	$ 40.18	20.00
GROUP 6	$ 40.29	20.00
GROUP 7	$ 40.41	20.00
GROUP 8	$ 40.58	20.00
GROUP 9	$ 40.75	20.00
GROUP 10	$ 41.75	20.00
GROUP 11	$ 42.75	20.00
GROUP 12	$ 43.75	20.00
GROUP 13	$ 44.75	20.00

OPERATOR: Power Equipment
(Tunnel Work)

GROUP 1	$ 39.25	20.00
GROUP 2	$ 40.03	20.00
GROUP 3	$ 40.32	20.00
GROUP 4	$ 40.46	20.00
GROUP 5	$ 40.68	20.00
GROUP 6	$ 40.79	20.00
GROUP 7	$ 40.91	20.00

PREMIUM PAY:
$3.75 per hour shall be paid on all Power Equipment Operator work on the followng Military Bases: China Lake Naval Reserve, Vandenberg AFB, Point Arguello, Seely Naval Base, Fort Irwin, Nebo Annex Marine Base, Marine Corp Logistics

Base Yermo, Edwards AFB, 29 Palms Marine Base and Camp Pendleton

Workers required to suit up and work in a hazardous material environment: $2.00 per hour additional. Combination mixer and compressor operator on gunite work shall be classified as a concrete mobile mixer operator.

SEE ZONE DEFINITIONS AFTER CLASSIFICATIONS

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Bargeman; Brakeman; Compressor operator; Ditch Witch, with seat or similar type equipment; Elevator operator-inside; Engineer Oiler; Forklift operator (includes loed, lull or similar types under 5 tons; Generator operator; Generator, pump or compressor plant operator; Pump operator; Signalman; Switchman

GROUP 2: Asphalt-rubber plant operator (nurse tank operator); Concrete mixer operator-skip type; Conveyor operator; Fireman; Forklift operator (includes loed, lull or similar types over 5 tons; Hydrostatic pump operator; oiler crusher (asphalt or concrete plant); Petromat laydown machine; PJU side dum jack; Screening and conveyor machine operator (or similar types); Skiploader (wheel type up to 3/4 yd. without attachment); Tar pot fireman; Temporary heating plant operator; Trenching machine oiler

GROUP 3: Asphalt-rubber blend operator; Bobcat or similar type (Skid steer); Equipment greaser (rack); Ford Ferguson (with dragtype attachments); Helicopter radioman (ground); Stationary pipe wrapping and cleaning machine operator

GROUP 4: Asphalt plant fireman; Backhoe operator (mini-max or similar type); Boring machine operator; Boxman or mixerman (asphalt or concrete); Chip spreading machine operator; Concrete cleaning decontamination machine operator; Concrete Pump Operator (small portable); Drilling machine operator, small auger types (Texoma super economatic or similar types - Hughes 100 or 200 or similar types - drilling depth of 30' maximum); Equipment greaser (grease truck); Guard rail post driver operator; Highline cableway signalman; Hydra-hammer-aero stomper; Micro Tunneling (above ground tunnel); Power concrete curing machine operator; Power concrete saw operator; Power-driven jumbo form setter operator; Power sweeper operator; Rock Wheel Saw/Trencher; Roller operator (compacting); Screed operator (asphalt or concrete); Trenching machine operator (up to 6 ft.); Vacuum or much truck

GROUP 5: Equipment Greaser (Grease Truck/Multi Shift).

GROUP 6: Articulating material hauler; Asphalt plant engineer; Batch plant operator; Bit sharpener; Concrete joint machine operator (canal and similar type); Concrete planer operator; Dandy digger; Deck engine operator;

Derrickman (oilfield type); Drilling machine operator, bucket or auger types (Calweld 100 bucket or similar types - Watson 1000 auger or similar types - Texoma 330, 500 or 600 auger or similar types - drilling depth of 45' maximum); Drilling machine operator; Hydrographic seeder machine operator (straw, pulp or seed), Jackson track maintainer, or similar type; Kalamazoo Switch tamper, or similar type; Machine tool operator; Maginnis internal full slab vibrator, Mechanical berm, curb or gutter(concrete or asphalt); Mechanical finisher operator (concrete, Clary-Johnson-Bidwell or similar); Micro tunnel system (below ground); Pavement breaker operator (truck mounted); Road oil mixing machine operator; Roller operator (asphalt or finish), rubber-tired earth moving equipment (single engine, up to and including 25 yds. struck); Self-propelled tar pipelining machine operator; Skiploader operator (crawler and wheel type, over 3/4 yd. and up to and including 1-1/2 yds.); Slip form pump operator (power driven hydraulic lifting device for concrete forms); Tractor operator-bulldozer, tamper-scraper (single engine, up to 100 h.p. flywheel and similar types, up to and including D-5 and similar types); Tugger hoist operator (1 drum); Ultra high pressure waterjet cutting tool system operator; Vacuum blasting machine operator

GROUP 8: Asphalt or concrete spreading operator (tamping or finishing); Asphalt paving machine operator (Barber Greene or similar type); Asphalt-rubber distribution operator; Backhoe operator (up to and including 3/4 yd.), small ford, Case or similar; Cast-in-place pipe laying machine operator; Combination mixer and compressor operator (gunite work); Compactor operator (self-propelled); Concrete mixer operator (paving); Crushing plant operator; Drill Doctor; Drilling machine operator, Bucket or auger types (Calweld 150 bucket or similar types - Watson 1500, 2000 2500 auger or similar types - Texoma 700, 800 auger or similar types - drilling depth of 60' maximum); Elevating grader operator; Grade checker; Gradall operator; Grouting machine operator; Heavy-duty repairman; Heavy equipment robotics operator; Kalamazoo balliste regulator or similar type; Kolman belt loader and similar type; Le Tourneau blob compactor or similar type; Loader operator (Athey, Euclid, Sierra and similar types); Mobark Chipper or similar; Ozzie padder or similar types; P.C. slot saw; Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pumpcrete gun operator; Rock Drill or similar types; Rotary drill operator (excluding caisson type); Rubber-tired earth-moving equipment operator (single engine, caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator (multiple engine up to and including 25 yds. struck); Rubber-tired scraper operator (self-loading paddle wheel type-John Deere, 1040 and similar single unit); Self-propelled curb and gutter machine operator; Shuttle buggy; Skiploader operator (crawler and wheel type over 1-1/2 yds. up to and including 6-1/2 yds.); Soil remediation plant

operator; Surface heaters and planer operator; Tractor compressor drill combination operator; Tractor operator (any type larger than D-5 - 100 flywheel h.p. and over, or similar-bulldozer, tamper, scraper and push tractor single engine); Tractor operator (boom attachments), Traveling pipe wrapping, cleaning and bendng machine operator; Trenching machine operator (over 6 ft. depth capacity, manufacturer's rating); trenching Machine with Road Miner attachment (over 6 ft depth capacity): Ultra high pressure waterjet cutting tool system mechanic; Water pull (compaction) operator

GROUP 9: Heavy Duty Repairman

GROUP 10: Drilling machine operator, Bucket or auger types (Calweld 200 B bucket or similar types-Watson 3000 or 5000 auger or similar types-Texoma 900 auger or similar types-drilling depth of 105' maximum); Dual drum mixer, dynamic compactor LDC350 (or similar types); Monorail locomotive operator (diesel, gas or electric); Motor patrol-blade operator (single engine); Multiple engine tractor operator (Euclid and similar type-except Quad 9 cat.); Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Pneumatic pipe ramming tool and similar types; Prestressed wrapping machine operator; Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Rubber tired earth moving equipment operator (multiple engine, Euclid, caterpillar and similar over 25 yds. and up to 50 yds. struck), Tower crane repairman; Tractor loader operator (crawler and wheel type over 6-1/2 yds.); Woods mixer operator (and similar Pugmill equipment)

GROUP 11: Heavy Duty Repairman - Welder Combination, Welder - Certified.

GROUP 12: Auto grader operator; Automatic slip form operator; Drilling machine operator, bucket or auger types (Calweld, auger 200 CA or similar types - Watson, auger 6000 or similar types - Hughes Super Duty, auger 200 or similar types - drilling depth of 175' maximum); Hoe ram or similar with compressor; Mass excavator operator less tha 750 cu. yards; Mechanical finishing machine operator; Mobile form traveler operator; Motor patrol operator (multi-engine); Pipe mobile machine operator; Rubber-tired earth- moving equipment operator (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck); Rubber-tired self- loading scraper operator (paddle-wheel-auger type self-loading - two (2) or more units)

GROUP 13: Rubber-tired earth-moving equipment operator operating equipment with push-pull system (single engine, up to and including 25 yds. struck)

GROUP 14: Canal liner operator; Canal trimmer operator; Remote- control earth-moving equipment operator (operating a second piece of equipment: $1.00 per hour additional);

Wheel excavator operator (over 750 cu. yds.)

GROUP 15: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine-up to and including 25 yds. struck)

GROUP 16: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 17: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 50 cu. yds. struck); Tandem tractor operator (operating crawler type tractors in tandem - Quad 9 and similar type)

GROUP 18: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, up to and including 25 yds. struck)

GROUP 19: Rotex concrete belt operator (or similar types); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds.and up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, up to and including 25 yds. struck)

GROUP 20: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps, and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 21: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

GROUP 22: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system

(single engine, up to and including 25 yds. struck)

GROUP 23: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating with the tandem push-pull system (multiple engine, up to and including 25 yds. struck)

GROUP 24: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 25: Concrete pump operator-truck mounted; Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

CRANES, PILEDRIVING AND HOISTING EQUIPMENT CLASSIFICATIONS

GROUP 1: Engineer oiler; Fork lift operator (includes loed, lull or similar types)

GROUP 2: Truck crane oiler

GROUP 3: A-frame or winch truck operator; Ross carrier operator (jobsite)

GROUP 4: Bridge-type unloader and turntable operator; Helicopter hoist operator

GROUP 5: Hydraulic boom truck; Stinger crane (Austin-Western or similar type); Tugger hoist operator (1 drum)

GROUP 6: Bridge crane operator; Cretor crane operator; Hoist operator (Chicago boom and similar type); Lift mobile operator; Lift slab machine operator (Vagtborg and similar types); Material hoist and/or manlift operator; Polar gantry crane operator; Self Climbing scaffold (or similar type); Shovel, backhoe, dragline, clamshell operator (over 3/4 yd. and up to 5 cu. yds. mrc); Tugger hoist operator

GROUP 7: Pedestal crane operator; Shovel, backhoe, dragline, clamshell operator (over 5 cu. yds. mrc); Tower crane repair; Tugger hoist operator (3 drum)

GROUP 8: Crane operator (up to and including 25 ton capacity); Crawler transporter operator; Derrick barge operator (up to and including 25 ton capacity); Hoist operator, stiff legs, Guy derrick or similar type (up to and including 25 ton capacity); Shovel, backhoe, dragline,

clamshell operator (over 7 cu. yds., M.R.C.)

GROUP 9: Crane operator (over 25 tons and up to and including 50 tons mrc); Derrick barge operator (over 25 tons up to and including 50 tons mrc); Highline cableway operator; Hoist operator, stiff legs, Guy derrick or similar type (over 25 tons up to and including 50 tons mrc); K-crane operator; Polar crane operator; Self erecting tower crane operator maximum lifting capacity ten tons

GROUP 10: Crane operator (over 50 tons and up to and including 100 tons mrc); Derrick barge operator (over 50 tons up to and including 100 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 50 tons up to and including 100 tons mrc), Mobile tower crane operator (over 50 tons, up to and including 100 tons M.R.C.); Tower crane operator and tower gantry

GROUP 11: Crane operator (over 100 tons and up to and including 200 tons mrc); Derrick barge operator (over 100 tons up to and including 200 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 100 tons up to and including 200 tons mrc); Mobile tower crane operator (over 100 tons up to and including 200 tons mrc)

GROUP 12: Crane operator (over 200 tons up to and including 300 tons mrc); Derrick barge operator (over 200 tons up to and including 300 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 200 tons, up to and including 300 tons mrc); Mobile tower crane operator (over 200 tons, up to and including 300 tons mrc)

GROUP 13: Crane operator (over 300 tons); Derrick barge operator (over 300 tons); Helicopter pilot; Hoist operator, stiff legs, Guy derrick or similar type (over 300 tons); Mobile tower crane operator (over 300 tons)

TUNNEL CLASSIFICATIONS

GROUP 1: Skiploader (wheel type up to 3/4 yd. without attachment)

GROUP 2: Power-driven jumbo form setter operator

GROUP 3: Dinkey locomotive or motorperson (up to and including 10 tons)

GROUP 4: Bit sharpener; Equipment greaser (grease truck); Slip form pump operator (power-driven hydraulic lifting device for concrete forms); Tugger hoist operator (1 drum); Tunnel locomotive operator (over 10 and up to and including 30 tons)

GROUP 5: Backhoe operator (up to and including 3/4 yd.); Small Ford, Case or similar; Drill doctor; Grouting machine operator; Heading shield operator; Heavy-duty repairperson; Loader operator (Athey, Euclid, Sierra and similar types);

Mucking machine operator (1/4 yd., rubber-tired, rail or track type); Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pneumatic heading shield (tunnel); Pumpcrete gun operator; Tractor compressor drill combination operator; Tugger hoist operator (2 drum); Tunnel locomotive operator (over 30 tons)

GROUP 6: Heavy Duty Repairman

GROUP 7: Tunnel mole boring machine operator

ENGINEERS ZONES

$1.00 additional per hour for all of IMPERIAL County and the portions of KERN, RIVERSIDE & SAN BERNARDINO Counties as defined below:

That area within the following Boundary: Begin in San Bernardino County, approximately 3 miles NE of the intersection of I-15 and the California State line at that point which is the NW corner of Section 1, T17N,m R14E, San Bernardino Meridian. Continue W in a straight line to that point which is the SW corner of the northwest quarter of Section 6, T27S, R42E, Mt. Diablo Meridian. Continue North to the intersection with the Inyo County Boundary at that point which is the NE corner of the western half of the northern quarter of Section 6, T25S, R42E, MDM. Continue W along the Inyo and San Bernardino County boundary until the intersection with Kern County, as that point which is the SE corner of Section 34, T24S, R40E, MDM. Continue W along the Inyo and Kern County boundary until the intersection with Tulare County, at that point which is the SW corner of the SE quarter of Section 32, T24S, R37E, MDM. Continue W along the Kern and Tulare County boundary, until that point which is the NW corner of T25S, R32E, MDM. Continue S following R32E lines to the NW corner of T31S, R32E, MDM. Continue W to the NW corner of T31S, R31E, MDM. Continue S to the SW corner of T32S, R31E, MDM. Continue W to SW corner of SE quarter of Section 34, T32S, R30E, MDM. Continue S to SW corner of T11N, R17W, SBM. Continue E along south boundary of T11N, SBM to SW corner of T11N, R7W, SBM. Continue S to SW corner of T9N, R7W, SBM. Continue E along south boundary of T9N, SBM to SW corner of T9N, R1E, SBM. Continue S along west boundary of R1E, SMB to Riverside County line at the SW corner of T1S, R1E, SBM. Continue E along south boundary of T1s, SBM (Riverside County Line) to SW corner of T1S, R10E, SBM. Continue S along west boundary of R10E, SBM to Imperial County line at the SW corner of T8S, R10E, SBM. Continue W along Imperial and Riverside county line to NW corner of T9S, R9E, SBM. Continue S along the boundary between Imperial and San Diego Counties, along the west edge of R9E, SBM to the south boundary of Imperial County/California state line. Follow the California state line west to Arizona state line, then north to Nevada state line, then continuing NW back to start at the point which is the NW corner of Section 1, T17N, R14E, SBM

$1.00 additional per hour for portions of SAN LUIS OBISPO,

KERN, SANTA BARBARA & VENTURA as defined below:

That area within the following Boundary: Begin approximately 5 miles north of the community of Cholame, on the Monterey County and San Luis Obispo County boundary at the NW corner of T25S, R16E, Mt. Diablo Meridian. Continue south along the west side of R16E to the SW corner of T30S, R16E, MDM. Continue E to SW corner of T30S, R17E, MDM. Continue S to SW corner of T31S, R17E, MDM. Continue E to SW corner of T31S, R18E, MDM. Continue S along West side of R18E, MDM as it crosses into San Bernardino Meridian numbering area and becomes R30W. Follow the west side of R30W, SBM to the SW corner of T9N, R30W, SBM. Continue E along the south edge of T9N, SBM to the Santa Barbara County and Ventura County boundary at that point whch is the SW corner of Section 34.T9N, R24W, SBM, continue S along the Ventura County line to that point which is the SW corner of the SE quarter of Section 32, T7N, R24W, SBM. Continue E along the south edge of T7N, SBM to the SE corner to T7N, R21W, SBM. Continue N along East side of R21W, SBM to Ventura County and Kern County boundary at the NE corner of T8N, R21W. Continue W along the Ventura County and Kern County boundary to the SE corner of T9N, R21W. Continue North along the East edge of R21W, SBM to the NE corner of T12N, R21W, SBM. Continue West along the north edge of T12N, SBM to the SE corner of T32S, R21E, MDM. [T12N SBM is a think strip between T11N SBM and T32S MDM]. Continue North along the East side of R21E, MDM to the Kings County and Kern County border at the NE corner of T25S, R21E, MDM, continue West along the Kings County and Kern County Boundary until the intersection of San Luis Obispo County. Continue west along the Kings County and San Luis Obispo County boundary until the intersection with Monterey County. Continue West along the Monterey County and San Luis Obispo County boundary to the beginning point at the NW corner of T25S, R16E, MDM.

$2.00 additional per hour for INYO and MONO Counties and the Northern portion of SAN BERNARDINO County as defined below:

That area within the following Boundary: Begin at the intersection of the northern boundary of Mono County and the California state line at the point which is the center of Section 17, T10N, R22E, Mt. Diablo Meridian. Continue S then SE along the entire western boundary of Mono County, until it reaches Inyo County at the point which is the NE corner of the Western half of the NW quarter of Section 2, T8S, R29E, MDM. Continue SSE along the entire western boundary of Inyo County, until the intersection with Kern County at the point which is the SW corner of the SE 1/4 of Section 32, T24S, R37E, MDM. Continue E along the Inyo and Kern County boundary until the intersection with San Bernardino County at that point which is the SE corner of section 34, T24S, R40E, MDM. Continue E along the Inyo and San Bernardino County boundary until the point which is the NE corner of the Western half of the NW quarter of Section 6, T25S, R42E, MDM. Continue S to that point which is the SW corner of the NW quarter of Section 6, T27S, R42E, MDM. Continue E in a straight line to the California and Nevada state border at the point which is the NW corner of Section 1,

T17N, R14E, San Bernardino Meridian. Then continue NW along the state line to the starting point, which is the center of Section 18, T10N, R22E, MDM.

REMAINING AREA NOT DEFINED ABOVE RECIEVES BASE RATE

ENGI0012-004 08/01/2012

	Rates	Fringes
OPERATOR: Power Equipment (DREDGING)		
(1) Leverman	$ 45.40	20.00
(2) Dredge dozer	$ 40.93	20.00
(3) Deckmate	$ 40.82	20.00
(4) Winch operator (stern winch on dredge)	$ 40.27	20.00
(5) Fireman-Oiler, Deckhand, Bargeman, Leveehand	$ 39.73	20.00
(6) Barge Mate	$ 40.34	20.00

IRON0002-004 07/01/2012

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 26.58	16.345
Ornamental, Reinforcing and Structural	$ 33.00	24.985

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

LABO0089-001 07/01/2012

	Rates	Fringes

LABORER (BUILDING and all other Residential Construction)		
Group 1	$ 27.10	15.17
Group 2	$ 27.56	15.17
Group 3	$ 27.97	15.17
Group 4	$ 28.81	15.17
Group 5	$ 32.93	15.17
LABORER (RESIDENTIAL CONSTRUCTION - See definition below)		
(1) Laborer	$ 23.48	14.13
(2) Cleanup, Landscaping, Fencing (chain link or wood)	$ 22.19	14.13

RESIDENTIAL DEFINITION: Wood or metal frame construction of single family residences, apartments and condominums - excluding (a) projects that exceed three stories over a garage level, (b) any utility work such as telephone, gas, water, sewer and other utilities and (c) any fine grading work, utility work or paving work in the future street and public right-of-way; but including all rough grading work at the job site behind the existing right of way

LABORER CLASSIFICATIONS

GROUP 1: Cleaning and handling of panel forms; Concrete Screeding for Rought Strike-off; Concrete, water curing; Demolition laborer; Flagman; Gas, oil and/or water pipeline laborer; General Laborer; General clean-up laborer; Landscape laborer; Jetting laborer; Temporary water and air lines laborer; Material hoseman (walls, slabs, floors and decks); Plugging, filling of Shee-bolt holes; Dry packing of concrete; Railroad maintenance, Repair Trackman and road beds, Streetcar and railroad construction trac laborers; Slip form raisers; Slurry seal crews (mixer operator, applicator operator, squeegee man, Shuttle man, top man), filling of cracks by any method on any surface; Tarman and mortar man; Tool crib or tool house laborer; Window cleaner; Wire Mesh puling-all concrete pouring operations

GROUP 2: Asphalt Shoveler; Cement Dumper (on 1 yard or larger mixer and handling bulk cement); Cesspool digger and installer; Chucktender; Chute man, pouring concrete, the handling of the cute from ready mix trucks, such as walls, slabs, decks, floors, foundations, footings, curbs, gutters and sidewalks; Concrete curer-impervious membrane and form oiler; Cutting torch operator (demoliton); Guinea chaser; Headboard man-asphlt; Laborer, packing rod steel and pans; membrane vapor barrier installer; Power broom sweepers (small); Riiprap, stonepaver, placing stone or wet sacked concrete; Roto scraper and tiller; Tank sealer and cleaner; Tree climber, faller, chain saw operator, Pittsburgh Chipper and similar type brush shredders; Underground laborers, including caisson bellower

GROUP 3: Buggymobile; Concrete cutting torch; Concrete cutting torch; Concrete pile cutter; Driller, jackhammer, 2 1/2 feet drill steel or longer; Dri Pak-it machine; High sealer (including drilling of same); Hydro seeder and similar type; Impact wrench, mult-plate; Kettlemen, potmen and mean applying asphalt, lay-kold, creosote, line caustic and similar type materials (applying means applying, dipping, brushing or handling of such materials for pipe wrapping and waterproofing); Operators of pneumatic, gas, electric tools, vibratring machines, pavement breakers, air blasting, come-along, and similar mechanical tools not separately classified herein; Pipelayers back up man coating, grouting, making of joints, sealing, caulking, diapering and inclduing rubber gasket joints, pointing and any and all other services; Rotary Scarifier or multiple head concrete chipping scaarifier; Steel header board man and guideline setter; Tampers, Barko, Wacker and similar type; Trenching machine, handpropelled

GROUP 4: Asphalt raker, luterman, ironer, apshalt dumpman and asphalt spreader boxes (all types); Concrete core cutter (walls, floors or ceilings), Grinder or sander; Concrete saw man; cutting walls or flat work, scoring old or new concrete; Cribber, shorer, lagging, sheeting and trench bracing, hand-guided lagging hammer; Laser beam in connection with laborer's work; Oversize concrete vibrator operator 70 pounds and over; Pipelayer performing all services in the laying, installation and all forms of connection of pipe from the point of receiving pipe in the ditch until completion of oepration, including any and all forms of tubular material, whether pipe, metallic or non-metallic, conduit, and any other stationary type of tubular device used for the conveying of any substance or element, whether water, sewage, solid, gas, air or other product whatsoever and without regard to the nature of material from which the tubular material is fabricated; No joint pipe and stripping of same; Prefabricated manhole installer; Sandblaster (nozzleman), Porta shot-blast, water blasting

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all pwder and explosives of whatever type, regardless of method used for such loading and placing; Driller-all power drills, excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and any and all other types of mechanical drills without regard to the form of motive power.

LABO0089-002 07/01/2010

	Rates	Fringes
LABORER (MASON TENDER).....	$ 27.11	14.38

LABO0089-004 07/01/2012

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
Laborers:		
GROUP 1	$ 27.10	15.17
GROUP 2	$ 27.56	15.17
GROUP 3	$ 27.97	15.17
GROUP 4	$ 28.81	15.17
GROUP 5	$ 32.93	15.17

LABORER CLASSIFICATIONS

GROUP 1: Laborer: General or Construction Laborer, Landscape Laborer. Asphalt Rubber Material Loader. Boring Machine Tender (outside), Carpenter Laborer (cleaning, handling, oiling & blowing of panel forms and lumber), Concrete Laborer, Concrete Screeding for rough strike-off, Concrete water curing. Concrete Curb & Gutter laborer, Certified Confined Space Laborer, Demolition laborer & Cleaning of Brick and lumber,Expansion Joint Caulking; Environmental Remediation, Monitoring Well, Toxic waste and Geotechnical Drill tender, Fine Grader, Fire Watcher, Limbers, Brush Loader, Pilers and Debris Handlers. flagman. Gas Oil and Water Pipeline Laborer. Material Hoseman (slabs, walls, floors, decks); Plugging, filling of shee bolt holes; Dry packing of concrete and patching; Post Holer Digger (manual); Railroad maintenance, repair trackman, road beds; Rigging & signaling; Scaler, Slip-Form Raisers, Filling cracks on any surface, tool Crib or Tool House Laborer, Traffic control (signs, barriers, barricades, delineator, cones etc.), Window Cleaner

GROUP 2: Asphalt abatement; Buggymobile; Cement dumper (on 1 yd. or larger mixers and handling bulk cement); Concrete curer, impervious membrane and form oiler; Chute man, pouring concrete; Concrete cutting torch; Concrete pile cutter; driller/Jackhammer, with drill steel 2 1/'2 feet or longer; Dry pak-it machine; Fence erector; Pipeline wrapper, gas, oil, water, pot tender & form man; Grout man; Installation of all asphalt overlay fabric and materials used for reinforcing asphalt; Irrigation laborer; Kettleman-Potman hot mop, includes applying asphalt, lay-klold, creosote, lime caustic and similar tyhpes of materials (dipping, brushing, handling) and waterproofing; Membrane vapor barrier installer; Pipelayer backup man (coating, grouting, making of joints, sealing caulkiing, diapering including rubber basket joints, pointing); Rotary scarifier, multiple head concrete chipper; Rock slinger; Roto scraper & tiller; Sandblaster pot tender; Septic tank digger/installer; Tamper/wacker operator; Tank scaler & cleaner; Tar man & mortar man; Tree climber/faller, chainb saw operator, Pittsburgh chipper & similar type brush shredders.

GROUP 3: Asphalt, installation of all frabrics; Buggy Mobile Man, Bushing hammer; Compactor (all types), Concrete Curer - Impervious membrane, Form Oiler, Concrete Cutting Torch, Concrete Pile Cutter,Driller/Jackhammer with drill steel 2

1/2 ft or longer, Dry Pak-it machine, Fence erector including manual post hole digging, Gas oil or water Pipeline Wrapper - 6 ft pipe and over, Guradrail erector, Hydro seeder, Impact Wrench man (multi plate), kettleman-Potman Hot Mop includes applying Asphalt, Lay-Kold, Creosote, lime caustic and similar types of materials (dipping, brushing or handling) and waterproofing. Laser Beam in connection with Laborer work. High Scaler, Operators of Pneumatic Gas or Electric Tools, Vibrating Machines, Pavement Breakers, Air Blasting, Come-Alongs and similar mechanical tools, Remote-Controlled Robotic Tools in connection with Laborers work. Pipelayer Backup Man (Coating, grouting,m makeing of joints, sealing, caulking, diapering including rubber gasket joints, pointing and other services). Power Post Hole Digger, Rotary Scarifier (multiple head concrete chipper scarifier), Rock Slinger, Shot Blast equipment (8 to 48 inches), Steel Headerboard Man and Guideline Setter, Tamper/Wacker operator and similar types, Trenching Machine hand propelled.

GROUP 4: Any worker exposed to raw sewage. Asphalt Raker, Luteman, Asphalt Dumpman, Asphalt Spreader Boxes, Concrete Core Cutter, Concrete Saw Man, Cribber, Shorer, Head Rock Slinger. Installation of subsurface instrumentation, monitoring wells or points, remediation system installer; Laborer, asphalt-rubber distributor bootman; Oversize concrete vibrator operators, 70 pounds or over. Pipelayer, Prfefabricated Manhole Installer, Sandblast Nozzleman (Water Balsting-Porta Shot Blast), Traffic Lane Closure.

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all powder and explosives of whatever type, regardless of method used for such loading and placing; Horizontal directional driller, Boring system, Electronic traking, Driller: all power drills excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and all other types of mechanical drills without regard to form of motive power. Environmental remediation, Monitoring well, Toxic waste and Geotechnical driller, Toxic waste removal. Welding in connection with Laborer's work.

LABO0300-008 08/05/2009

	Rates	Fringes
LABORER		
PLASTER CLEAN-UP LABORER	$ 26.65	15.95
PLASTER TENDER	$ 29.20	15.95

Work at Military Bases - $3.00 additional per hour:
Coronado Naval Amphibious Base, Fort Irwin, Marine Corps Air Station-29 Palms, Imperial Beach Naval Air Station, Marine Corps Logistics Supply Base, Marine Corps Pickle Meadows, Mountain Warfare Training Center, Naval Air Facility-Seeley, North Island Naval Air Station, Vandenberg

AFB.

LABO0882-002 01/01/2010

	Rates	Fringes
Asbestos Removal Laborer.....	$ 26.15	11.65

SCOPE OF WORK: Includes site mobilization, initial site cleanup, site preparation, removal of asbestos-containing material and toxic waste, encapsulation, enclosure and disposal of asbestos- containing materials and toxic waste by hand or with equipment or machinery; scaffolding, fabrication of temporary wooden barriers and assembly of decontamination stations.

LABO1184-001 08/01/2012

	Rates	Fringes
Laborers: (HORIZONTAL DIRECTIONAL DRILLING)		
(1) Drilling Crew Laborer...	$ 29.01	11.68
(2) Vehicle Operator/Hauler.	$ 29.18	11.68
(3) Horizontal Directional Drill Operator.....	$ 31.03	11.68
(4) Electronic Tracking Locator.....	$ 33.03	11.68
Laborers: (STRIPING/SLURRY SEAL)		
GROUP 1.....	$ 29.96	14.38
GROUP 2.....	$ 31.26	14.38
GROUP 3.....	$ 33.27	14.38
GROUP 4.....	$ 35.01	14.38

LABORERS - STRIPING CLASSIFICATIONS

GROUP 1: Protective coating, pavement sealing, including repair and filling of cracks by any method on any surface in parking lots, game courts and playgrounds; carstops; operation of all related machinery and equipment; equipment repair technician

GROUP 2: Traffic surface abrasive blaster; pot tender - removal of all traffic lines and markings by any method (sandblasting, waterblasting, grinding, etc.) and preparation of surface for coatings. Traffic control person: controlling and directing traffic through both conventional and moving lane closures; operation of all related machinery and equipment

GROUP 3: Traffic delineating device applicator: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices including traffic control. This category includes all traffic related surface preparation (sandblasting, waterblasting, grinding) as part of the

application process. Traffic protective delineating system installer: removes, relocates, installs, permanently affixed roadside and parking delineation barricades, fencing, cable anchor, guard rail, reference signs, monument markers; operation of all related machinery and equipment; power broom sweeper

GROUP 4: Striper: layout and application of traffic stripes and markings; hot thermo plastic; tape traffic stripes and markings, including traffic control; operation of all related machinery and equipment

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PAIN0036-001 01/01/2012

	Rates	Fringes
Painters: (Including Lead Abatement)		
(1) Repaint (excludes San Diego County)	$ 26.05	10.35
(2) All Other Work	$ 29.32	10.35

REPAINT of any previously painted structure. Exceptions: work involving the aerospace industry, breweries, commercial recreational facilities, hotels which operate commercial establishments as part of hotel service, and sports facilities.

PAIN0036-010 10/01/2012

	Rates	Fringes
DRYWALL FINISHER/TAPER		
(1) Building & Heavy Construction	$ 25.08	12.69
(2) Residential Construction (Wood frame apartments, single family homes and multi-duplexes up to and including four stories)	$ 21.00	12.06

PAIN0036-012 10/01/2012

	Rates	Fringes
GLAZIER	$ 38.80	16.25

PAIN0036-019 02/01/2009

	Rates	Fringes
SOFT FLOOR LAYER	$ 26.77	11.75

PLAS0200-005 08/01/2011

	Rates	Fringes

PLASTERER.....$ 35.29 12.05

NORTH ISLAND NAVAL AIR STATION, COLORADO NAVAL AMPHIBIOUS BASE, IMPERIAL BEACH NAVAL AIR STATION: $3.00 additional per hour.

PLAS0500-001 07/01/2012

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER		
GROUP 1	$ 26.47	12.10
GROUP 2	$ 28.12	12.10
GROUP 3	$ 30.75	12.60

CEMENT MASONS - work inside the building line, meeting the following criteria:

GROUP 1: Residential wood frame project of any size; work classified as Type III, IV or Type V construction; interior tenant improvement work regardless the size of the project; any wood frame project of four stories or less.

GROUP 2: Work classified as type I and II construction

GROUP 3: All other work

PLUM0016-006 07/01/2012

	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER		
Camp Pendleton	$ 46.10	19.68
Plumber and Pipefitter All other work except work on new additions and remodeling of bars, restaurant, stores and commercial buildings not to exceed 5,000 sq. ft. of floor space and work on strip malls, light commercial, tenant improvement and remodel work	$ 41.60	19.68
Work ONLY on new additions and remodeling of commercial buildings, bars, restaurants, and stores not to exceed 5,000 sq. ft. of floor space	$ 40.33	18.70
Work ONLY on strip malls, light commercial, tenant improvement and remodel work	$ 32.49	17.03

PLUM0016-011 07/01/2012

	Rates	Fringes
PLUMBER/PIPEFITTER		
Residential	$ 33.63	15.60

PLUM0345-001 07/01/2012

	Rates	Fringes
PLUMBER		
Landscape/Irrigation Fitter	$ 27.35	17.09
Sewer & Storm Drain Work	$ 31.00	16.01

ROOF0045-001 07/01/2012

	Rates	Fringes
ROOFER	$ 25.08	7.28

SFCA0669-001 04/01/2012

	Rates	Fringes
SPRINKLER FITTER	$ 34.18	18.51

SHEE0206-001 01/01/2012

	Rates	Fringes
SHEET METAL WORKER		
Camp Pendleton	$ 35.05	19.23
Except Camp Pendleton	$ 33.05	19.23
Sheet Metal Technician	$ 25.22	6.69

SHEET METAL TECHNICIAN - SCOPE:
a. Existing residential buildings, both single and multi-family, where each unit is heated and/or cooled by a separate system b. New single family residential buildings including tracts. c. New multi-family residential buildings, not exceeding five stories of living space in height, provided each unit is heated or cooled by a separate system. Hotels and motels are excluded. d. LIGHT COMMERCIAL WORK: Any sheet metal, heating and air conditioning work performed on a project where the total construction cost, excluding land, is under $1,000,000 e. TENANT IMPROVEMENT WORK: Any work necessary to finish interior spaces to conform to the occupants of commercial buildings, after completion of the building shell

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TEAM0036-001 07/01/2012

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 15.40	20.50

GROUP 2	$ 24.99	20.50
GROUP 3	$ 25.19	20.50
GROUP 4	$ 25.39	20.50
GROUP 5	$ 25.59	20.50
GROUP 6	$ 26.09	20.50
GROUP 7	$ 27.59	20.50

FOOTNOTE: HAZMAT PAY: Work on a hazmat job, where hazmat certification is required, shall be paid, in addition to the classification working in, as follows: Levels A, B and C - +$1.00 per hour. Workers shall be paid hazmat pay in increments of four (4) and eight (8) hours.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Fuel Man, Swamper

GROUP 2: 2-axle Dump Truck, 2-axle Flat Bed,Concrete Pumping Truck, Industrial Lift Truck, Motorized Traffic Control, Pickup Truck on Jobsite

GROUP 3: 2-axle Water Truck, 3-axle Dump Truck, 3-axle Flat Bed, Erosion Control Nozzleman, Dump Crete Truck under 6.5 yd, Forklift 15,000 lbs and over, Prell Truck, Pipeline Work Truck Driver, Road Oil Spreader, Cement Distributor or Slurry Driver, Bootman, Ross Carrier

GROUP 4: Off-road Dump Truck under 35 tons 4-axles but less than 7-axles, Low-Bed Truck & Trailer, Transit Mix Trucks under 8 yd, 3-axle Water Truck, Erosion Control Driver, Grout Mixer Truck, Dump Crete 6.5yd and over, Dumpster Trucks, DW 10, DW 20 and over, Fuel Truck and Dynamite, Truck Greaser, Truck Mounted Mobile Sweeper 2-axle Winch Truck

GROUP 5: Off-road Dump Truck 35 tons and over, 7-axles or more, Transit Mix Trucks 8 yd and over, A-Frame Truck, Swedish Cranes

GROUP 6: Off-Road Special Equipment (including but not limited to Water Pull Tankers, Athey Wagons, DJB, B70 Wuclids or like Equipment)

GROUP 7: Repairman

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rates.

0000/9999: weighted union wage rates will be published annually each January.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

11. FEDERAL LABOR STANDARDS PROVISIONS (Office of the Secretary of Labor 29 CFR 5):

Applicability

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. Minimum Wages. (i) All laborers and mechanics employed or working upon the site of the work, (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project) will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section l(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

(ii) (A) Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Federal Agency or its designee shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding. The Federal Agency or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the Federal Agency or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records. (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section l(b)(2)(B) of the Davis-bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section l(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under

approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii) (A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Agency or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to the Federal Agency or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i) except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired.

Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at

http://www.dol.gov/esa/whd/forms/wh347instr.htm

or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Federal Agency or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to the Federal Agency , the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or, owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph A.3.(ii)(b)of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under subparagraph A.3.(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Agency or its designee or the Department of Labor, and shall permit such representatives to

interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, Federal agency or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees. (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination.

Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant ',to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by

the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in 29 CFR 5.59(a)(1) through (10 and such other clauses as the Federal Agency may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1)..

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

b. Contract Work Hours and Safety Standards Act. The provisions of this paragraph b are applicable where the amount of the prime contract exceeds $100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation

at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (b)(1) of this section, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (b)(1) of this paragraph, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in sub paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The Federal Agency or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (b)(1) through (4) of this section.

C. In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in Sec. 5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

12. AGENCY SPECIFIC PROVISIONS:

Note: Failure to comply with these specifications e.g., taking the specified steps prior to Bid opening, and to submit the forms located in Volume 2 with the Bid will lead to the Bid being declared **non-responsive** and, therefore, shall be rejected.

12.1. <u>All EPA Funded Contracts:</u>

1. Federal Disadvantaged Business Enterprise (DBE) regulations apply to this project. (Reference 40 Code of Federal Regulations Part 33 - Participation by Disadvantaged Business Enterprises in U.S. Environmental Protection Agency Programs).

2. The responsive Bid shall conform to GFE to increase DBE awareness of procurement opportunities through race and gender neutral efforts. Race and gender neutral efforts are ones which increase awareness of contracting opportunities in general, including outreach, recruitment and technical assistance.

3. Bidder agrees that it will cooperate with and assist the City in fulfilling the DBE Good Faith Effort Requirement achieving "fair share objectives" and will exercise GFE to achieve such minimum participation of small, minority and women owned businesses. In particular, in submitting a bid, the Bidder shall, in the selection of Subcontractors, and Suppliers for the procurement of equipment, supplies, construction, and services related to the project, at a minimum, undertake the affirmative GFE steps.

4. In accordance with EPA's Program for Utilization of Small, Minority Disadvantaged and Women Business Enterprises in procurement under Federal assistance programs, the Contractor agrees to the applicable "fair share objectives" as specified in the "Special Notice" page.

5. The provisions in the Contract Documents have been incorporated to prevent unfair practices that adversely affect DBEs.

6. If a DBE Subcontractor fails to complete the Work under the subcontract for any reason, the Contractor shall employ the 6 GFE if soliciting a replacement Subcontractor. The Contractor shall employ the 6 GFE described below even if the Contractor has achieved its fair share objectives.

7. Good Faith Efforts:

   a) The Contractor shall demonstrate that efforts were made to attract DBEs on this contract. The "Good Faith" effort requires the Contractor and any Subcontractors to take the steps listed in these specifications to assure that DBEs are used whenever possible as sources of supplies, construction, equipment, or services even if the Contractor has achieved its fair share objectives.

   b) If the Contractor awards subcontracts, it shall require the Subcontractors to take the steps in these specifications.

   c) For the EPA defined GFE, see the steps below:

      1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on

solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process. Include with the GFE documentation a completed copy of the form AA61, "List of Work Made Available."

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the U.S. Small Business Administration (SBA) and the Minority Business Development Agency (MDBA) of the Department of Commerce (DOC). See "DBE Potential Resources Centers" Section in a later part these specifications.

6. If the Contractor awards Subcontracts, the Contractor shall take the steps in paragraphs (1) through (5) above.

12.1.1. **Clean Water State Revolving Fund (CWSRF) Projects Only:**

12.1.2. For contracts subject to CWSRF, refer to Subsection 1, "All EPA Funded Contracts" above and the following:

12.1.3. The Bidder shall take affirmative steps prior to Bid opening to assure that MBE's and WBE's are used whenever possible as sources of supplies, construction and services.

12.1.4. The affirmative steps are defined for contracts funded by the California State Water Resources Control Board as follows:

1. Utilization of SBA and MBDA resources is required at no cost. These agencies offer several services, including Internet access to databases of DBEs. SBA's database is http://www.ccr.gov/

2. For additional assistance, the Contractor can telephone the local offices of both agencies in their area (SBA Minority Enterprise Development Offices and DOC MBDA Regional Centers). The Internet web sites also include names, addresses, and phone or fax numbers of local SBA and MBDA centers. There are contact phone numbers listed in Step 3 that will assist you in reaching the 2 offices if the Internet is unavailable. Do not write to these sources.

3. The Contractor shall provide documentation that the local SBA/MBDA offices or web sites were notified of the contracting bid opportunity at least 15 Working Days prior to Bid opening and solicitation to DBE Subcontractors at least 10 Working Days prior to Bid opening. Documentation shall not only include the efforts to contact the information sources and list the Contract opportunity, but also the solicitation and response to the bid request.

4. Include qualified DBEs on solicitation lists (CWSRF Form 1) and record the information. Solicitation shall be as broad as possible. The following web sites include a list of available sources for expanding the search for eligible DBEs:

    1. http://www.sba.gov
    2. http://www.ccr.gov
    3. http://www.mbda.gov

5. If DBE sources are not located, explain why and describe the efforts made.

6. The Contractor shall send invitations to at least 3 (or all, if less than 3) DBE vendors for each item of the Work referred by sources contacted. The invitations shall adequately specify the items for which bids are requested. The record of GFE shall indicate a real desire for a positive response, such as a certified mail receipt or a documented telephone conversation.

7. A regular letter or an unanswered telephone call is not an adequate "good faith" effort. A list of all Subcontractors, including the bidders not selected and non DBE Subcontractors, and bid amount for each item of the Work shall be submitted on Form 5. If a low bid was not accepted, an explanation shall be provided.

8. See "DBE Potential Resources Centers" Section in a later part these specifications.

12.1.5. Semiannual DBE Utilization Reporting:

The Contractor shall report to the City on a semiannual basis, their utilization of Minority Business Enterprise and Women's Business Enterprise Subcontractors and Suppliers using EPA Form 5700-52A.

13. DBE POTENTIAL RESOURCES CENTERS:

13.1. Utilization of SBA and MBDA resources is required at no cost. These agencies offer several services, including Internet access to databases of DBEs.

13.2. For additional assistance, the recipient or contractor can telephone the local offices of both agencies in their area (SBA Minority Enterprise Development Offices and DOC MBDA Regional Centers). The Internet web sites also include names, addresses, and phone or fax numbers of local SBA and MBDA centers. Do not write to these sources

13.3. The Contractor shall provide documentation that the local SBA/MBDA offices or web sites were notified of the contracting bid opportunity at least 15 Working Days prior to Bid opening and solicitation to DBE subcontractors at least 10 Working Days

prior to Bid opening. Documentation shall not only include the efforts to contact the information sources and list the Contract opportunity, but also the solicitation and response to the bid request.

13.4. Include qualified DBEs on solicitation lists and record the information. Solicitation shall be as broad as possible. The following web sites include a list of available sources for expanding the search for eligible DBEs:

1. http://www.sba.gov
2. http://www.ccr.gov
3. http://www.mbda.gov

13.5. If DBE sources are not located, explain why and describe the efforts made.

13.6. The Contractor shall send invitations to at least 3 (or all, if less than 3) DBE vendors for each item of work referred by sources contacted. The invitations shall adequately specify the items for which bids are requested. The record of "good faith" efforts shall indicate a real desire for a positive response, such as a certified mail receipt or a documented telephone conversation.

13.7. A regular letter or an unanswered telephone call is not an adequate "good faith" effort. A list of all sub-bidders, including the bidders not selected and non DBE Subcontractors, and bid amount for each item of the Work shall be submitted on Form 5. If a low bid was not accepted, an explanation shall be provided.

13.8. Federal Agencies (must be contacted and solicitations posted on their websites):

Name and Address	Telephone and Web Site
U.S. Small Business Administration	(415) 744-6820 Extension 0
455 Market Street, Suite 600	PRO-Net Database: http://www.ccr.gov/[1]
San Francisco, CA 94105	Bid Notification: http://web.sba.gov/subnet/[2]
RE: Minority Enterprise Development Offices	
U.S. Department of Commerce	(415) 744-3001
Minority Business Development Agency	Phoenix/ Opportunity Database:
211 Main Street, Room 1280	http://www.mbda.gov[3]
San Francisco, CA 94105	RE: Business Development Centers

13.9. State Agencies (optional contacts):

Name and Address	Telephone and Web Site
California Department of Transportation	Mailing Address: PO Box 942874
(CALTRANS) Business Enterprise Program[4]	Sacramento, CA 94274-0015
1820 Alhambra Blvd.	(916) 227-9599
Sacramento, CA 95816	www.dot.ca.gov/hq/bep
CA Public Utilities Commission (CPUC)[5]	

505 Van Ness Avenue San Francisco, CA 94102-3298	http://www.cpuc.ca.gov/static/supplierdiversity

Notes:

1. PRO-Net new database is the SBA's electronic search engine that was put on line January 1, 2004, containing business profiles for nearly 200,000 businesses. The SBA requests Internet contact only for a list of potential DBE subcontractors that can be downloaded from PRO-Net: http://www.ccr.gov. Downloading will verify that the prime contractor made the required contact with the SBA.
2. The Contractor shall use SUB-Net to post subcontracting opportunities. The Contractor shall post Subcontractor opportunities at least 15 Working Days prior to bid opening. Small businesses can review this web site to identify opportunities in their areas of expertise. The web site is designed primarily as a place for large businesses to post solicitations and notices. Provide copy of the Display Solicitation Record with the GFE documentation.
3. The Contractors shall use MBDA web portal to post subcontracting opportunities. The Contractor shall post subcontractor opportunities at least 15 Working Days prior to Bid opening. Small businesses can review this web site to identify opportunities in their areas of expertise. The web site is designed primarily as a place for large businesses to post solicitations and notices. Provide copy of the Offer Overview with the GFE documentation.
4. Based on the federal DBE program, CALTRANS maintains a database and provides directories of minority and woman-owned firms.
5. CPUC maintains a database of DBE-owned business enterprises and serves to inform the public.

14. GOOD FAITH EFFORT DOCUMENTATION SUBMITTALS:

14.1. The affirmative GFE steps documentation shall be submitted **within 4 Working Days of the Bid Opening.** If this documentation is not submitted when due, the City will declare the Bid/Proposal **non-responsive** and reject it.

14.2. The required documentation shall be submitted and logged in at the following address:

CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1010 SECOND AVENUE SUITE 1400 MS 614C
SAN DIEGO, CA 92101
SUBJECT: AFFIRMATIVE GOOD FAITH EFFORTS DOCUMENTATION
BID NO. **K-13-5573-DB2-3**

14.3. The Contractor shall maintain the records documenting compliance with requirements including documentation of its GFE and data relied upon in formulating its fair share objectives.

15. FORMS:

15.1. The Contractor shall demonstrate that efforts were made to attract DBEs on this contract. The Contractor and Subcontractors shall take the steps listed in these specifications to assure that DBEs are used whenever possible as sources of supplies, construction, equipment, or services. In addition to the specified GFE documentation, the Bidder shall submit the following forms.\

15.2. See EPA forms 6100-2, 6100-3, and 6100-4 for additional required information to comply with EPA requirements. These forms are included in the Contract Documents or shall be obtained from: http://www.epa.gov/osbp/dbe_forms.htm. The following EPA forms in Volume 2 shall be completed and submitted with the Bid. Failure to include any

of the forms shall cause the Bid to be deemed **non-responsive.**

1. EPA FORM 6100-3: DBE Subcontractor Performance Form
2. EPA FORM 6100-4: DBE Subcontractor Utilization Form

15.3. The following CWSRF forms in Volume 1 shall be completed and submitted within 4 Working Days of the Bid opening. Failure to include any of the forms shall cause the Bid to be deemed **non-responsive.**

1. CWSRF Form 1: Good Faith Effort List of Subcontractors Solicited
2. CWSRF Form 2: Good Faith Effort Bids Received List
3. CWSRF Form 3: Contractor Certification shall be completed and submitted 1 Working Days after Bid opening.
4. CWSRF Form 4: Prime Contractor/Recipient Selected DBEs
5. CWSRF Form 5: Summary of Bids Received from Subcontractors
6. Form AA61: List of Work Made Available

16. ATTACHMENTS:

1. EPA FORM 6100-2: DBE Subcontractor Participation Form (Volume 1)
2. EPA FORM 6100-3: DBE Subcontractor Performance Form (Volume 2)
3. EPA FORM 6100-4: DBE Subcontractor Utilization Form (Volume 2)
4. EPA Form 5700-52A MBE/WBE Utilization Forms (Volume 1)
5. CWSRF Form 1: Good Faith Effort List of Subcontractors Solicited (Volume 1)
6. CWSRF Form 2: Good Faith Effort Bids Received List (Volume 1)
7. CWSRF Form 3: Contractor Certification shall be completed and submitted 1 Working Days after Bid opening. (Volume 1)
8. CWSRF Form 4: Prime Contractor/Recipient Selected DBEs (Volume 1)
9. CWSRF Form 5: Summary of Bids Received from Subcontractors (Volume 1)
10. Form AA61: List of Work Made Available

OMB Control No.: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental
Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Participation Form

NAME OF SUBCONTRACTOR[1]	**PROJECT NAME**
ADDRESS	**BID/PROPOSAL NO.**
TELEPHONE NO.	**EMAIL ADDRESS**
PRIME CONTRACTOR NAME	

Please use the space below to report any concerns regarding the above EPA-funded project (e.g., reason for termination by prime contractor, late payment, etc.).

CONTRACT ITEM NO.	**ITEM OF WORK OR DESCRIPTION OF SERVICES RECEIVED FROM THE PRIME CONTRACTOR**	**AMOUNT SUBCONTRACTOR WAS PAID BY PRIME CONTRACTOR**

Subcontractor Signature _____ Title/Date _____

[1]Subcontractor is defined as companies, firm, join venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance

OMB CONTROL NO. 2090-0030
APPROVED: 05/01/2008
APPROVAL EXPIRES: 12/22/2013

U.S. ENVIRONMENTAL PROTECTION AGENCY
MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

PART I. (Reports are required even if no procurements are made during the reporting period.)

1A. FEDERAL FISCAL YEAR (Oct. 1-Sep 30), _____	1B. REPORTING PERIOD (Check ALL appropriate boxes) ☐ 1st (Oct-Dec) ☐ 2nd (Jan-Mar) ☐ 3rd (Apr-Jun) ☐ 4th (Jul-Sep) ☐Semi-Annual (Oct-Mar) ☐ Semi-Annual (Apr-Sep) ☐ Annual ☐ Check if this is the last report for the project (Project completed).
1C. REVISION OF A PRIOR REPORT? ☐Yes ☐No Year: _____ Quarter: _____	BRIEFLY DESCRIBE THE REVISIONS YOU ARE MAKING:

2A. EPA FINANCIAL ASSISTANCE OFFICE ADDRESS (ATTN: DBE Coordinator):		3A. RECIPIENT NAME AND ADDRESS	
2B. EPA DBE COORDINATOR Name: E-mail:	2C. PHONE: Fax:	3B. RECIPIENT REPORTING CONTACT: Name: E-mail:	3C. PHONE: Fax:
4A. FINANCIAL ASSISTANCE AGREEMENT ID NUMBER (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.)		4B. FEDERAL FINANCIAL ASSISTANCE PROGRAM TITLE or CFDA NUMBER:	

5A. TOTAL ASSISTANCE AGREEMENT AMOUNT (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.) EPA Share: $_____ Recipient Share: $_____	5B. If NO procurement and NO accomplishments were made this reporting period (by the recipients, sub-recipients, loan recipients, and prime contractors), **CHECK** and **SKIP** to Block No. 7. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs. Accomplishments, in this context, are procurements made with MBEs and/or WBEs. ☐
5C. Total Procurements This Reporting Period (Only include amount not reported in any prior reporting period) Total Procurement Amount $_____ (Include total dollar values awarded by recipient, sub-recipients and SRF loan recipients, **including MBE/WBE expenditures.)**	
5D. Were sub-awards issued under this assistance agreement? Yes ☐ No ☐ Were contracts issued under this assistance agreement ? Yes ☐ No ☐	

5E. MBE/WBE Accomplishments This Reporting Period

Actual MBE/WBE Procurement Accomplished:
(Include total dollar values awarded by recipient, sub-recipients, SRF loan recipients and Prime Contractors.)

	Construction	Equipment	Services	Supplies	Total
$MBE:					
$WBE:					

6. COMMENTS: (If no MBE/WBE procurements were accomplished during the reporting period, please explain what steps you are taking to achieve the MBE/WBE Program requirements specified in the terms and conditions of the Assistance Agreement.)	
7. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	TITLE
8. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	DATE

EPA FORM 5700-52A available electronically at http://www.epa.gov/osbp/pdfs/5700_52a.pdf

PART II. **MBE/WBE PROCUREMENTS MADE DURING REPORTING PERIOD**

EPA Financial Assistance Agreement Number: _____

1. Procurement Made By			2. Business Enterprise		3. $ Value of Procurement	4. Date of Procurement MM/DD/YY	5. Type of Product or ServicesA (Enter Code)	6. Name/Address/Phone Number of MBE/WBE Contractor or Vendor
Recipient	Sub-Recipient and/or SRF Loan Recipient	Prime	Minority	Women				

Type of product or service codes:

1 = Construction 2 = Supplies 3 = Services 4 = Equipment

Note: Refer to Terms and conditions of your Assistance Agreement to determine the frequency of reporting. Recipients are required to submit MBE/WBE reports to EPA beginning with the Federal fiscal year quarter the recipients receive the award, continuing until the project is completed.

EPA FORM 5700-52A - (Approval Expires 12/22/13)

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. EPA Form 5700-52A must be completed by recipients of Federal grants, cooperative agreements, or other Federal financial assistance which involve procurement of supplies, equipment, construction or services to accomplish Federal assistance programs.

Recipients are required to report 30 days after the end of each federal fiscal quarter, semiannually, or annually, per the terms and conditions of the financial assistance agreement.

	Quarterly Reporting Due Date	Semiannual Reporting Due Date	Annual Reporting Due Date
Agreements awarded prior to May 27, 2008	January 30, April 30, July 30, October 30	N/A	October 30
Agreements awarded on or after May 27, 2008	N/A	April 30, October 30	October 30

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

B. Definitions:

Procurement is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

A ***contract*** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

A ***minority business enterprise*** **(MBE)** is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

A ***woman business enterprise*** **(WBE)** is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact managed and operated by non-minority individuals do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

Good Faith Efforts

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Include of MBEs/WBEs on solicitation lists.

2. Assure that MBEs/WBEs are solicited once they are identified.

3. Divide total requirements into smaller tasks to permit maximum MBE/WBE participation, where feasible.

4. Establish delivery schedules which will encourage MBE/WBE participation, where feasible.

5. Encourage use of the services of the U.S. Department of Commerce's Minority Business Development Agency (MBDA) and the U.S. Small Business Administration to identify MBEs/WBEs.

6. Require that each party to a subgrant, subagreement, or contract award take the good faith efforts outlined here.

C. Instructions for Part I:

1a. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2010 falls within Federal fiscal year 2011**)

1b. Check applicable reporting box, quarterly, semiannually, or annually. Also indicate if this is the last report for the project.

1c. Indicate if this is a revision to a previous year, half-year, or quarter, and provide a brief description of the revision you are making.

2a-c. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.

The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at www.epa.gov/osbp. Click on "Regional Contacts" for the name of your coordinator.

3a-c. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.

4a. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients**: In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form. Please note that although the New DBE Rule (which took effect May 27, 2008) revised the reporting frequency requirements from quarterly to semiannually, that change only applies to agreements awarded AFTER the New DBE Rule took effect. Therefore, SRF recipients may either continue to report activity for all Agreements on one form on a quarterly basis until the last award that was made prior to the New DBE Rule has been closed out; OR, the recipient may split the submission of SRF reports into quarterly reports for Agreements awarded prior the New DBE Rule, and semiannually for the awards made after the New DBE Rule.

4b. Refer back to Assistance Agreement document for this information.

5a. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: SRF recipients will not enter an amount in 5a. Please leave 5a blank.

5b. Self-explanatory.

5c. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

***NOTE**: To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.

5d. State whether or not sub-awards and/or subcontracts have been issued under the assistance agreement by indicating "yes" or "no".

5e. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: In 5c please enter the total procurement amount for the quarter, or semiannual period, under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

6. If there were no MBE/WBE accomplishments this reporting period, please briefly explain what specific steps you are taking to achieve the MBE/WBE requirements specified in the terms and conditions of the Assistance Agreement.

7. Name and title of official administrator or designated reporting official.

8. Signature, month, day, and year report submitted.

D. Instructions for Part II:

For each MBE/WBE procurement made under this assistance agreement during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.

2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the "Value of the Procurement" reported in column #3**

3. Dollar value of procurement.

4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**

5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc).

6. Name, address, and telephone number of MBE/WBE firm.

**This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Part 30,

31, and 33); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average 1 hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.

Clean Water State Revolving Fund Loan Program DBE Instructions

FORM 1

DISADVANTAGE BUSINESS ENTERPRISE (DBE)
"GOOD FAITH" EFFORT LIST OF SUBCONTRACTORS SOLICITED

Form with information required to be submitted with the AOA package.

Contractor Name	Contractor Address	How Located	Date of Contact	Contact Method	Task Description	Response (Yes/No)

Clean Water State Revolving Fund Loan Program DBE Instructions
FORM 2

DISADVANTAGE BUSINESS ENTERPRISE(DBE)
"GOOD FAITH" EFFORT BIDS RECEIVED LIST

Contractor Name	Category (DBE)	Task Description	Bid Amount	Selected (Check)	Explanation for Not Selecting

Form with information required to be submitted with the AOA package.
January 2009

Clean Water State Revolving Fund Loan Program DBE Instructions

FORM 3

DISADVANTAGE BUSINESS ENTERPRISE (DBE)

CONTRACTOR CERTIFICATION

Firm Name:	Phone:

Address:

Principal Service or Product: _____ Bid Amount $ _____

PLEASE INDICATE PERCENTAGE OF OWNERSHIP

☐ DBE _____% Ownership

☐ Prime Contractor ☐ Supplier of Material/Service

☐ Subcontractor ☐ Broker

☐ Sole Ownership ☐ Corporation

☐ Partnership ☐ Joint Venture

Certified by: _____ Title: _____
DBE Sub (ORIGINAL SIGNATURE AND DATE REQUIRED)

Name: _____ Date: _____

IMPORTANT: CONTRACTORS CAN NO LONGER SELF-CERTIFY. THEY MUST BE CERTIFIED BY EPA, SMALL BUSINESS ADMINISTRATION (SBA), DEPARTMENT OF TRANSPORTATION (DOT) OR BY STATE, LOCAL, TRIBAL OR PRIVATE ENTITIES WHOSE CERTIFICATION CRITERIA MATCH EPA'S. PROOF OF CERTIFICATION MUST BE PROVIDED. A COPY OF THE CONTRACTOR CERTIFICATION MUST BE SUBMITTED WITH THIS FORM.

THIS FORM MUST BE SUBMITTED WITHIN 4 WORKING DAYS AFTER THE BID OPENING DATE.

January 2009

Clean Water State Revolving Fund Loan Program DBE Instructions
FORM 4 (Attachment B)

PRIME CONTRACTOR/RECIPIENT

SELECTED DISADVANTAGE BUSINESS ENTERPRISE (DBE)

<table>
<tr><td colspan="2">CONTRACT RECIPIENTS NAME:</td><td>CONTRACT NO. OR SPECIFICATION NO.:</td></tr>
<tr><td colspan="2">PROJECT DESCRIPTION:</td><td>PROJECT LOCATION:</td></tr>
<tr><td colspan="3">PRIME CONTRACTOR INFORMATION</td></tr>
<tr><td colspan="2">NAME AND ADDRESS (Include Zip Code, Federal Employer Tax ID #):

PHONE:</td><td>AMOUNT OF CONTRACT $</td></tr>
<tr><td colspan="3">DBE INFORMATION</td></tr>
<tr><td colspan="2">☐NONE*</td><td></td></tr>
<tr><td colspan="2">☐DBE</td><td rowspan="3">NAME AND ADDRESS (INCLUDE ZIP CODE)</td></tr>
<tr><td>☐ SUBCONTRACTOR
☐ JOINT VENTURE</td><td>☐ SUPPLIER/SERVICE
☐ BROKER</td></tr>
<tr><td colspan="2">AMOUNT OF CONTRACT $</td></tr>
<tr><td colspan="3">WORK TO BE PERFORMED</td></tr>
<tr><td colspan="2">☐DBE</td><td rowspan="3">NAME AND ADDRESS (INCLUDE ZIP CODE)

PHONE:</td></tr>
<tr><td>☐ SUBCONTRACTOR
☐ JOINT VENTURE</td><td>☐ SUPPLIER/SERVICE
☐ BROKER</td></tr>
<tr><td colspan="2">AMOUNT OF CONTRACT $</td></tr>
<tr><td colspan="3">WORK TO BE PERFORMED</td></tr>
<tr><td colspan="2">☐DBE</td><td rowspan="3">NAME AND ADDRESS (INCLUDE ZIP CODE)

PHONE:</td></tr>
<tr><td>☐ SUBCONTRACTOR
☐ JOINT VENTURE</td><td>☐ SUPPLIER/SERVICE
☐ BROKER</td></tr>
<tr><td colspan="2">AMOUNT OF CONTRACT $</td></tr>
<tr><td colspan="3">WORK TO BE PERFORMED</td></tr>
<tr><td colspan="3">TOTAL DBE AMOUNT: $_____

SIGNATURE OF PERSON COMPLETING FORM:_____

TITLE:_____ PHONE:_____ DATE:_____</td></tr>
</table>

***Negative reports are required. ORIGINAL SIGNATURE AND DATE REQUIRED. Failure to complete and submit this form within 4 Working Days of bid opening will cause bid to be rejected as non-responsive.**

January 2009

Clean Water State Revolving Fund Loan Program DBE Instructions

FORM 5

SUMMARY OF BIDS RECEIVED FROM SUBCONTRACTOR, SUPPLIERS, AND BROKERS (DBE & NON-DBE)						
THIS SUMMARY IS PREPARED BY THE PRIME CONTRACTOR						
Type of Job	**Company Name**	**Selected**	**Bid Amount**	**DBE**	**NON-DBE**	**Explanation for Not Selecting**
List type of jobs alphabetically, from low to high in each category and selected low bidder.						

January 2009

LIST OF WORK MADE AVAILABLE

List items of the Work the Bidder made available to DBE firms. Identify those items of the Work the Bidder might otherwise perform with its own forces and those items that have been broken down into economically feasible units to facilitate DBE participation. For each item listed, show the dollar amount and percentage of the Base Bid. The Bidder must demonstrate that enough work to meet the goal was made available to DBE firms.

ITEM OF WORK MADE AVAILABLE	NAICS CODE	BIDDER NORMALLY PERFORMS ITEM (Y/N)	ITEM BROKEN DOWN TO FACILITATE PARTICIPATION (Y/N)	AMOUNT	PERCENTAGE OF BASE BID

CONTRACT FORMS
AGREEMENT

DESIGN-BUILD AGREEMENT

DS This Phase-Funded Design-Build agreement [Contract] is made and entered into this 30TH day of APRIL, 2013, by and between The City of San Diego [City], a municipal corporation, and J.R. FILANC CONSTRUCTION COMPANY, INC. [Design-Builder], for the purpose of designing and constructing the **MBC Dewatering Centrifuges Replacement Design-Build Contract** in the amount of NINE MILLION THREE HUNDRED SEVENTY-THREE THOUSAND NINE HUNDRED FIFTY-FOUR DOLLARS AND 00/100 ($9,373,954.00), with Phase I funding being for $1,759,300.00, Phase II funding being for $4,413,254.00 and Phase III funding being for $3,201,400.00. The City and Design-Builder are referred to herein as the "Parties."

RECITALS

A. City desires to construct the Project located in the City of San Diego, California.

B. City desires to contract with a single entity for design and construction of the Project, as set forth in this agreement.

C. The City has issued a Request for Proposals [RFP] for **K-13-5573-DB2-3** pursuant to which the City solicited Proposals from design-build teams to design, rehabilitate, and build the Project.

D. In accordance with City's RFP, Design-Builder submitted a Proposal for the Project and is prepared to enter into this agreement.

E. The City has selected the Design-Builder to perform, either directly or pursuant to Subcontracts, hereinafter defined, the design, engineering, and construction services set forth in this agreement and the Contract Documents, hereinafter defined.

F. This Agreement is a Phase-Funded agreement as described above.

G. The City is only obligated to issue and pay for Phase I. The Design-Builder will be notified if the City has sufficient funds for Phase II and whether Phase II will be awarded. There is no legal obligation to issue Phase II.

H. The Design-Builder is ready, willing, and able to perform the services required in accordance with the terms and conditions of this agreement.

I. Execution of this agreement by the Design-Builder is a representation that the Design-Builder has visited the Site, become familiar with the local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

In consideration of the above recitals and the mutual covenants and conditions set forth herein, and for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby set forth their mutual covenants and understandings as follows.

AGREEMENT

A. Recitals and Exhibits. The above referenced recitals are true and correct and are incorporated into this agreement by this reference. All Exhibits referenced in this agreement are incorporated into the Contract by this reference.

B. Contract Performance. The Design-Builder shall design and construct the Project in good and workmanlike manner to the satisfaction of the City, Lien free and in compliance with the Contract Documents and within the time specified, in return for timely payment by the City in Accordance with the phase funded schedule.

C. Contract Documents. This Contract incorporates the 2009 Edition of the Standard Specifications for Public Works Construction [Greenbook], including supplemental amendments set forth in the 2010 edition of the San Diego Standard Specifications for Public Works Construction [Whitebook]. The Contract Documents shall have the order of precedence set forth in section 2-5.2 of the Whitebook.

D. Phase Funding. This Project is funded in phases, and only Phase I is fully funded at this time. The attached Phase Funded Schedule dated March 28, 2012, is hereby incorporated in to the Contract Documents by reference, with only Phase I being currently funded. The Design-Builder shall not commence any work beyond Phase I work until the City notifies the Design- Builder that funds are available for Phase II and issues an NTP for Phase II.

IN WITNESS WHEREOF, this agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Resolution No. R - N/A.

THE CITY OF SAN DIEGO

By Tony Hemrick

Print Name: Tony Hemricks
Mayor or designee

Date: 5/31/13

APPROVED AS TO FORM AND LEGALITY

Jan I. Goldsmith, City Attorney

By

Print Name: Jeremy Jung
Deputy City Attorney

Date: 6-6-13

CONTRACTOR

By

Print Name: DAVID J. KIESS

Title: VICE PRESIDENT

Date: 4/30/2013

City of San Diego License No.: B19940006411

State Contractor's License No.: 134877

CONTRACT FORMS (continued)
PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

J.R. FILANC CONSTRUCTION COMPANY, INC., a corporation, as principal, and Fidelity and Deposit Company of Maryland, 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 NINE MILLION THREE HUNDRED SEVENTY-THREE THOUSAND NINE HUNDRED FIFTY-FOUR DOLLARS AND 00/100 ($9,373,954.00) for the faithful performance of the annexed contract, and in the sum of NINE MILLION THREE HUNDRED SEVENTY-THREE THOUSAND NINE HUNDRED FIFTY-FOUR DOLLARS AND 00/100 ($9,373,954.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract **MBC Dewatering Centrifuges Replacement Design-Build Contract**, Bid Number: **K-13-5573-DB2-3**, 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 Chapter 3 of Division 5 of Title I of the Government Code of the State of California or under the provisions of Section 3082 et seq. 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.

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

Dated May 1, 2013

Approved as to Form and Legality

Jan I. Goldsmith, City Attorney

By _____
Deputy City Attorney

Approved:

By _____
Mayor or Designee

J. R. Filanc Construction Company, Inc.
Principal

By _____

DAVID J. KIESS VICE PRESIDENT
Printed Name of Person Signing for Principal

Fidelity and Deposit Company of Maryland
Surety

By _____
Tara Bacon, Attorney-in-fact

777 S. Figueroa Street, Suite 3900
Local Address of Surety

Los Angeles, CA 90017
Local Address (City, State) of Surety

(818) 409-2800
Local Telephone No. of Surety

Premium $69,736.00

Bond No. 8891489

ACKNOWLEDGMENT

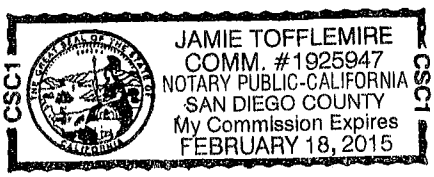
State of California
County of San Diego

On May 1, 2013 before me, Jamie Tofflemire, Notary Public, personally appeared Tara Bacon, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that she executed the same in her authorized capacity, and that by her signature on the instrument the person, or the entity upon behalf of which the person 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 _____



(Seal)

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Maryland, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Maryland (herein collectively called the "Companies"), by **JAMES M. CARROLL, Vice President,** in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Bradley R. ORR, Dale G. HARSHAW, Tara BACON and Kyle KING, all of San Diego, California, EACH** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND,** this 27th day of March, A.D. 2013.

ATTEST:

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: _____
Assistant Secretary
Gerald F. Haley

_____
Vice President
James M. Carroll

State of Maryland
City of Baltimore

On this 27th day of March, A.D. 2013, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **JAMES M. CARROLL, Vice President, and GERALD F. HALEY, Assistant Secretary,** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

_____
Maria D. Adamski, Notary Public
My Commission Expires: July 8, 2015

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Vice President of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 1st day of May, 2013.

Thomas O. McClellan, Vice President

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

PROJECT TITLE: MBC Dewatering Centrifuges Replacement Design-Build Contract

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 INSTRUCTION TO BIDDERS, "Drug-Free Workplace", of the project specifications, and that;

J.R. FILANC CONSTRUCTION CO., INC.
(Name under which business is conducted)

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.

Signed _____

Printed Name DAVID J. KIESS

Title VICE PRESIDENT

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

PROJECT TITLE: MBC Dewatering Centrifuges Replacement Design-Build Contract

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 INSTRUCTION TO BIDDERS, "American With Disabilities Act", of the project specifications, and that;

J.R. FILANC CONSTRUCTION CO., INC.
(Name under which business is conducted)

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.

Signed David J. Kiess

Printed Name DAVID J. KIESS

Title VICE PRESIDENT

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

PROJECT TITLE: MBC Dewatering Centrifuges Replacement Design-Build Contract

I declare under penalty of perjury that I am authorized to make this certification on behalf of J.R. FILANC CONSTRUCTION CO., INC., as Contractor, that I am familiar with the requirements of City of San Diego Municipal Code § 22.3224 regarding Contractor Standards as outlined in INSTRUCTION TO BIDDERS ("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 § 22.3224.

Dated this 30TH Day of APRIL, 2013.

Signed _____

Printed Name DAVID J. KIESS

Title VICE PRESIDENT

AFFIDAVIT OF DISPOSAL

WHEREAS, on the _____ DAY OF _____, _____, the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

MBC Dewatering Centrifuges Replacement Design-Build Contract
(Name of Project or Task)

as particularly described in said contract and identified as Bid No. **K-13-5573-DB2-3**; SAP No. (WBS/IO/CC) **S-00339,** 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

PHASED FUNDING SCHEDULE AGREEMENT

Check one: ☒ First Phased Funding Schedule Agreement

BID NUMBER: K-12-5573-DB2 (WBS No. S-00339)

CONTRACT TITLE: MBC Dewatering Centrifuges Replacement Design - Build Contract

CONTRACTOR: J. R. Filanc Construction Company, Inc.

Funding Phase	Phase Description	Phase Start	Phase Finish	Not-to-Exceed Amount
1	Mobilization, procurement, installation, testing, and acceptance of 2 centrifuges, installation of pinch valves, and initiation of procurement of 2 additional centrifuges.	5/7/2013 (NTP)	8/31/2013	$1,759,300.00
2	Completion of procurement, installation, testing, and acceptance of second set of 2 centrifuges, and initiation of procurement of final set of 2 centrifuges.	9/1/2013	7/31/2014	$4,413,254.00
3	Completion of procurement, installation, testing, and acceptance of final set of 2 centrifuges, demobilization, and project closeout.	8/1/2014	6/30/2015	$3,201,400.00
			Total	$9,373,954.00

Notes:

(1) City Supplement 9-3.6, "PHASE FUNDING COMPENSATION" applies.

(2) The total of all funding phases shall be equal to the TOTAL BID PRICE as shown on BID SCHEDULE 1 - PRICES.

(3) This PHASE FUNDING SCHEDULE AGREEMENT will be incorporated into the CONTRACT and shall only be revised by a written modification to the CONTRACT.

CITY OF SAN DIEGO

By: _____

Name: Idalmiro Manuel da Rosa
Project Manager

Department Name: Public Works, E&CP

Date: _____

CONTRACTOR

By: J. R. Filanc Construction Company, Inc.

Name: David J. Kiess

Title: VICE PRESIDENT

Date: 4/30/2013

-END OF PHASE FUNDING SCHEDULE-

SUPPLEMENTARY SPECIAL PROVISIONS

THESE SUPPLEMENTARY SPECIAL PROVISIONS CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (THE GREENBOOK) CURRENTLY ADOPTED BY THE CITY, INCLUDING ITS CURRENT SUPPLEMENT AMENDMENTS (CITY SUPPLEMENTS INCLUDED IN THE WHITEBOOK), EXCEPT FOR THE FOLLOWING:

STYLE OF SPECIFICATIONS

The City is gradually standardizing the style and language of the standard specifications for the public works construction. The new style and language follows the Federal guidelines for "Plain Language" to the extent possible.

The use of this new style does not change the meaning of a specification not yet using this style. Where used in the Contract Documents, statement or command type phrases (i.e., active voice and imperative mood) refer to and are directed at the Bidder or Contractor as applicable. The specifications are written to the Bidder before award and the Contractor after. Before award, interpret sentences written in the imperative mood as starting with "The Bidder must" and interpret "you" as "the Bidder" and "your" as "the Bidder's." After award, interpret sentences written in the imperative mood as starting with "The Contractor must" and interpret "you" as "the Contractor" and "your" as "the Contractor's." Similarly, interpret "we" and "us" as "the City" and "our" as "the City's."

PART 1 – GENERAL PROVISIONS

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

1-2 TERMS AND DEFINITIONS.

Agency – ADD the following:

Regulatory activities handled by the City of San Diego Developmental Services, Fire and Planning Departments, or any other City Department are not subject to the responsibilities of the City under this contract.

Certificate of Compliance – To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Certificate of Compliance – A written document signed and submitted by a supplier or manufacturer that certifies that the material or assembled material supplied to the Work site complies with the requirements of the Contract Documents.

Contract Documents – To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

The Agreement, Addendum, Invitation to Bid, Instructions to Bidders, special notice page, funding agency provisions, Bid and documentation accompanying the Bid and any post-bid documentation submitted prior to the Notice of Award when attached as an exhibit to the Contract, Bonds, permits from jurisdictional regulatory agencies, Supplementary Special Provisions (SSP), City's EOCP Requirements, City Supplement, Plans, Standard Plans, Construction Documents, Reference Specifications listed in the Invitation to Bid or the RFP for Design-Build contracts, Request for Qualifications (RFQ), Statement of Qualifications (SOQ), Request for Proposals (RFP), modifications issued after the execution of the Contract e.g., Change Orders, Construction Manager At Risk's Guaranteed Maximum Price including written qualifications, assumptions and conditions thereto and Pre-construction Services Agreement.

ADD: **Limited Notice To Proceed** – A written notice given from the City to the Contractor that authorizes the Contractor to start a limited amount of work that is not Construction Work, such as finalizing subcontract agreements, ordering materials, mobilization, furnishing a field office, and any other preliminary work done prior to performing Construction Work.

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

The Normal Working Hours shall be 7:00 AM to 3:30 PM.

Notice of Completion (NOC) – ADD the following:

See California Civil Code section 3093.

Samples - Physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be evaluated.

SECTION 2 - SCOPE AND CONTROL OF WORK2-1.2.2 Joint Venture Contractors. To the City Supplement, last paragraph, DELETE in its entirety and SUBSTITUTE with the following:

The Joint Venture shall designate an on-site representative and an alternate in writing. The on-site representative and the alternate shall have the full authority to bind all Joint Venture partners.

The Joint Venture shall provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receipt by the Bidder of Contract forms.

2-3.1.2 Subcontractor List. ADD the following:

For Extra Work, the Contractor shall submit Form CC10, "CONTRACT CHANGE ORDER (CCO)" with each CCO proposal. Form CC10 is available for download from the EOCP site at: http://www.sandiego.gov/eoc/pdf/cc10.pdf

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

The Contractor shall perform, with its own organization, Contract work amounting to at least **50** percent 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 determining the Apparent Low Bidder as specified. The self performance percentage requirement will be waived for contracts when a "B" License is required or allowed.

2-3.3 Status of Subcontractors. ADD the following:

With every request for payment, the Contractor shall submit to the Engineer a breakdown showing monthly and cumulative amounts of the Work performed under Change Order by the Contractor and the Subcontractors. The reporting format shall be approved by the Engineer.

2-3.4 Subcontract Requirements. To the City Supplement, ADD the following paragraph:

The Contractor shall ensure that all of its Subcontractors are licensed at the time of the execution of their subcontract agreements. In the event a Subcontractor is not properly licensed, the Contractor shall cease payment to Subcontractor for all work performed when the Subcontractor was improperly licensed. Any payment made by the Contractor to a Subcontractor for work performed when the Subcontractor was unlicensed shall be returned to the City.

Where the Contract Documents require that a particular product be installed or applied by an applicator approved by the manufacturer, it is the Contractor's responsibility to ensure the Subcontractor or Supplier employed for such work is approved by the manufacturer.

2-5.2 Precedence of Contract Documents. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

2-5.2 Precedence of Contract Documents. If there is a conflict between any of the Contract Documents, the document highest in the order of precedence shall control. The order of precedence, from highest to lowest, shall be as follows:

1) Permits (i.e., issued by jurisdictional regulatory agencies)
2) Change Orders and Supplemental Agreements; whichever occurs last
3) Contract and Agreement
4) Addenda
5) Bid (e.g., price Proposal for Design-Build contracts)
6) Request for Proposal (RFP)
7) Invitation to Bid
8) Instruction to Bidders
9) Request for Qualifications (RFQ)
10) Special Provisions (i.e., City's EOCP Requirements, City Supplement, and Supplementary Special Provisions (SSP))
11) Plans
12) Construction Documents (for Design-Build contracts)
13) Standard Drawings
14) Reference Specifications (e.g., GREENBOOK)
15) Technical Proposal (for Design-Build contracts)
16) Statement of Qualifications (SOQ)

When additional requirements by the funding sources are physically or by reference incorporated in the Contract Documents, the funding source's requirements shall govern **unless specified otherwise.**

Figured dimensions shall take precedence over scaled dimensions. Detailed drawings shall take precedence over general drawings.

2-5.3.1 General. DELETE in its entirety and SUBSTITUTE with the following:

When required by the Contract Documents or when requested by the Construction Manager, the Design-Builder shall provide the submittals as specified in 2-5.3.2, 2-5.3.3, and 2-5.3.4 to the Construction Manager. Materials shall neither be furnished nor fabricated, nor shall any work for which submittals are required be performed before the required submittals have been reviewed and accepted by the Construction Manager. The payment for the submittals shall be included in the various Bid items. Neither review nor acceptance of submittals by the Construction Manager shall relieve the Design-Builder from responsibility for errors, omissions, or deviations from the Contract Documents, unless such deviations were specifically called to the attention of the Construction Manager in the letter of transmittal. The Design-Builder shall be responsible for the correctness of the submittals.

The Design-Builder shall allow a minimum of 20 working days for review of submittals unless otherwise specified in the Special Provisions. Each submittal shall be accompanied by a letter of transmittal.

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or Equal") submittals listed in the Bid.
2. A list of all permits and licenses the DESIGN-BUILDER shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

At the preconstruction conference referred to in Section 6-1.8, the Design-Builder shall submit the following items to the Construction Manager for review:

1. A plan of operation.
2. A project overview bar chart.
3. A preliminary schedule of values.

2-5.3.4 Supporting Information. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

2-5.3.4 Supporting Information. ADD the following:

1. For landscaping and irrigation materials, submit samples and test results to the Construction Manager within 15 days of the NTP in accordance with 2-5.3, "Submittals".
2. Submit samples of the materials with cut sheets of the products. Organize cut sheets in a binder for review and approval by the Construction Manager prior to use on the Project. Cut sheets shall include the Project Name, Project Number, Contractor Name, Submittal Number and clearly indicate the specific product to be used. When photos of material are required, they shall be clear in resolution, identifying the specific item for review, indicating name of the item, source and date taken. The material shown in the photo shall be currently available for use on the project.
3. Identify deviation from any of the specified material clearly, including cut sheets and samples of both the specified material and basis for the substitution.

ADD 2-5.3.5 Shop Drawings.

A. Wherever called for in the Contract Documents, or where required by the Construction Manager, the Design-Builder shall furnish to the Construction Manager for review, 6 copies, plus the number the Design-Builder wants returned, not to exceed 12 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.

B. All shop drawing submittals shall be accompanied by the Construction Manager's standard submittal transmittal form. A copy of the form is shown in the Contract Administration Forms section of this Contract. The form may be obtained in quantity from the Construction Manager at reproduction cost. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Construction Manager.

D. Except as may otherwise be indicated herein, the Construction Manager will return prints of each submittal to the Design-Builder with its comments noted thereon, within 30 calendar days following their receipt by the Construction Manager. It is considered reasonable that the Design-Builder shall make a complete and acceptable submittal to the Construction Manager by the second submission of a submittal item. The Owner reserves the right to withhold monies due the Design-Builder to cover additional costs of the Construction Manager's review beyond the second submittal. The Construction Manager's maximum review period for each submittal, including all resubmittals, will be 30 days per submittal. In other words, for a submittal that requires two resubmittals before it is complete, the maximum review period for that submittal could be 90 days.

E. If a submittal is returned to the Design-Builder marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

F. If a submittal is returned to the Design-Builder marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.

G. If a submittal is returned to the Design-Builder marked "AMEND-RESUBMIT" or "REJECTED-RESUBMIT", the Design-Builder shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Construction Manager.

H. Fabrication of an item shall be commenced only after the Construction Manager has reviewed the pertinent submittals and returned copies to the Design-Builder 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.

I. All Design-Builder shop drawing submittals shall be carefully reviewed by an authorized representative of the Design-Builder, prior to submission to the Construction Manager. Each submittal shall be dated, signed, and certified by the Design-Builder, 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 Construction Manager of any Design-Builder submittals will be made for any items which have not been so certified by the Design-Builder. All non-certified submittals will be returned to the Design-Builder without action taken by the Construction Manager, and any delays caused thereby shall be the total responsibility of the Design-Builder.

J. The Construction Manager's review of Design-Builder shop drawing submittals shall not relieve the Design-Builder of the entire responsibility for the correctness of details and dimensions. The Design-Builder shall assume all responsibility and risk for any misfits due to any errors in Design-Builder submittals. The Design-Builder shall be responsible for the dimensions and the design of adequate connections and details.

ADD 2-5.3.6 Samples.

A. Whenever in the Specifications samples are required, the Design-Builder shall submit not less than 3 samples of each such item or material to the Construction Manager for acceptance at no additional cost to the Owner.

B. Samples, as required herein, shall be submitted for acceptance a minimum of 21 days prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.

C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name for identification and submitted to the Construction Manager for acceptance. Upon receiving acceptance of the Construction Manager, one set of the samples will be stamped and dated by the Construction Manager and returned to the Design-Builder, and one set of samples will be retained by the Construction Manager, and one set of samples shall remain at the job site until completion of the WORK.

D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, the Design-Builder will clearly indicate same on the transmittal page of the submittal.

ADD 2-5.3.7 Owner's Manual.

A. The Design-Builder 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.

B. 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):

1. Part 1 - Equipment Summary

    a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

    b. Form: The Construction Manager will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The Design-Builder shall fill in the relevant information on the form and include it in Part 1.

2. Part 2 - Operational Procedures

    a. Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:

        1. Installation
        2. Adjustment
        3. Startup
        4. Location of controls, special tools or other equipment required or related instrumentation needed for operation
        5. Operation Procedures
        6. Load Changes
        7. Calibration
        8. Shutdown
        9. Troubleshooting
        10. Disassembly
        11. Reassembly

12. Realignment

13. Testing to determine performance efficiency

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

15. List of all electrical relay settings including alarm and contact settings

3. Part 3 - Preventive Maintenance Procedures

   a. 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.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

4. Part 4 - Parts List

   a. 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.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

5. Part 5 - Wiring Diagrams

   a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Part 6 - Shop Drawings

   a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

7. Part 7- Safety

   a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation

   a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

C. The Design-Builder shall furnish to the Construction Manager 7 identical Owner's MANUALS. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, looseleaf, 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.

D. Owner's MANUALS shall be submitted in final form to the Construction Manager not later than the 75 percent of construction completion date. All discrepancies found by the Construction Manager in the Owner's MANUALS shall be corrected by the Design-Builder within 30 days from the date of written notification by the Construction Manager.

E. Incomplete or unacceptable Owner's MANUALS at the 75 percent construction completion point shall constitute sufficient justification to withhold the amount stipulated in paragraph "Owner's MANUAL Submittals" of Section 01700, from any monies due the Design-Builder.

ADD: 2-5.3.8 Instruction of Owner's Personnel.

A. **General:**

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 two (2) years experience in training. A resume for the representative shall be submitted to the Construction Manager.
3. No later than 30 calendar days prior to starting up operation of the first installed centrifuge, the Design-Builder shall have the Manufacturer's authorized representative instruct the OWNER'S personnel in the operation and maintenance of the equipment for a total of 40 hours (five 8-hour days). Instruction shall be both in the classroom and in the field. Training dates shall be coordinated with the OWNER a minimum of four (4) weeks in advance.
4. Proposed training material, including detailed outlines of each lesson, training handouts, and performance evaluations for each trade group indicated shall be submitted in hard copy and electronic format, in compliance with the requirements of this specification, to the Construction Manager's designated training coordinator for review at least three (3) days in advance of the training. All comments shall be provided via the Construction Manager and shall be incorporated into the material prior to the training session.
5. Training handouts and materials shall remain with the trainees.
6. The Owner may video tape the training sessions for later use with the Owner's personnel.
7. The training of OWNER'S personnel shall include but not be limited to:

<u>Operator Training</u>

- Pre-start up inspections of the centrifuges
- Step-by step start up procedure from both the control panel and from the DCS
- Step-by-step shutdown procedure from both the control panel and from the DCS
- Step-by-step CIP procedure
- Step-by-step trouble shooting procedures with necessary test equipment
- Performance optimization
- Troubleshooting

<u>Maintenance Training</u>

- Installation checks and frequency
- Lubrication procedure, type and frequency of the various centrifuge components
- Checking and adjusting belt tension
- Field demonstration of the removal, disassembly, assembly and installation of the rotating assembly
- Step-by-step procedure to replace all items included in the spare parts lists
- Troubleshooting

<u>Electrical & Instrumentation</u>

- Instrument layout of control panels.
- PLC hardware and software training
- Hardware and software interlocks

- Vibration monitoring
- Troubleshooting

All trainees, number as listed, shall receive a training manual for use during the class and shall be retained by the trainees. The training manuals shall be specific to their trade as follows:

a) Operators (8 copies)

b) Mechanical staff (5 copies)

c) Electrical and Instrumentation staff (5 copies)

Five (5) additional training manuals of each trade shall be submitted to the CONSTRUCTION MANAGER.

B. **Vendor Training Package:**

1. The Design-Builder shall submit technical information to be used in the operation and maintenance training of the Owner's personnel in an organized manner in a Vendor Training Package. The Vendor Training Package shall be written so that it can be used and understood by the Owner's operation and maintenance staff for training purposes.
2. All training sessions shall consist of classroom training and on-site field training. Classroom training shall include preparation of equipment for operations, startup procedures, normal operations shutdown procedures, emergency shutdown procedures, recommended preventative maintenance, major maintenance procedures, identification of required lubricants for all climatic conditions, review of required spare parts and maintenance tools, equipment disassembly and reassembly procedures and trouble-shooting procedure and review of maintenance requirements.
3. The Vendor Training Package shall be subdivided first by specification section number; and second, by Owner's trade group designation.
4. Vendor Training Package shall be further subdivided into trade specific PACKAGES for any combination of the following Owner's trade groups as identified in the technical specifications:

   (1) Electrician

   (2) Electronics Technician

   (3) Plant Operator

   (4) Plant Maintenance Technician

5. Vendor Training Package shall be written specific to the job description for each Owner's trade group as follows:

   a. Electronics Technician: Electronics technicians are responsible for preventive and corrective maintenance on instrumentation and control (I&C) equipment. This equipment includes but is not limited to electrical, pneumatic, hydraulic, and thermal control systems. Specific examples of types of equipment electronics technicians are responsible for are 120 volts equipment control panels, 4-20 mAdc control systems, 3-15 psig equipment and programmable logic controllers. Electronics technicians do not perform work on electrical power and mechanical equipment.

   b. Electrician: Electricians are responsible for preventive and corrective maintenance on electrical equipment. This equipment includes but is not limited to electric motors, motor control centers, uninterruptable power systems, unit substations, protective relays and routine programming of PLCs and electrical panels. Electricians may be

required to do alignments if they had to remove and replace or uncouple an electric motor in the course of their work. Electricians do not perform work on mechanical and I&C equipment.

c. Operator: Operators' responsibilities will include starting, stopping, adjusting and monitoring equipment performance, maintenance, and first line troubleshooting. Problems found will be referred to appropriate maintenance personnel.

d. Plant Maintenance Technician: Plant maintenance technicians will be responsible for trouble shooting and diagnosing mechanical failure. They will inspect, maintain, and perform repairs and overhauls. They will also performs corrective, preventative, and predictive maintenance. The list of equipment to be maintained may include, but is not limited to, air compressors, elevators, bridge cranes, pumps, HVAC, plumbing, valves, and piping. Plant maintenance technicians will be responsible for all routine alignments but will not perform work involving electrical power, instrumentation, or control.

6. For each Owner's trade group specified, Vendor Training Package shall include a cover sheet, instruction overview sheet, detailed outline/instructor guides, training handouts, audio/visual materials, and performance evaluations. Each shall conform, as applicable, to the following:

   a. Cover Sheet: Each cover sheet shall include:

      (1) Name of Owner's facility

      (2) Trade group specified, for example, Operator Training Package

      (3) Construction Contract name

      (4) Specification Section name and number

      (5) Course name, for example Waste Activated Sludge Pumps

      (6) Session name, must relate to specified trade group, for example WAS Pump Operations

      (7) Computer file name and date generated

   b. Instruction Overview Sheet: Each instruction overview sheet shall include:

      (1) Goal Statement: To be provided by the Owner

      (2) Student Learning Objectives: To be provided by the Owner

      (3) Session Duration: Identified in the technical specifications, the Construction Manager's written approval is required to deviate from these hours.

      (4) Instructional Approach: Provide a brief description of how the session will be presented to the Owner's personnel.

      (5) Reference Materials: List all reference materials used in the development of the PACKAGE, or during the training session.

      (6) Training Aids: List all training aids to be used during the instruction of Owner's personnel.

      (7) Training Room facilities shall be provided by the Design-Builder. The Design-Builder shall prepare a list of items that will be required to set up the training room setup, for example, overhead projector, video player and monitor, extension cords, etc. These items will be provide by the Owner to facilitate the

training. All tools, special tools, lubricants and test equipment required for training shall be provided by the Design-Builder.

(8) Teaching Effectiveness Evaluation Technique: The Design-Builder shall list the type of teaching effectiveness evaluation standards to be administered. Test materials and scores will remain with Owner.

c. Instructor Guides: Instructor guides containing detailed outlines shall be used during the delivery of training to the Owner's personnel, and shall be provided to the Owner at the conclusion of the training session. Each instructor guide shall include notations for Time, Session Text, and Instructor Activity as follows:

(1) Time: A time-to-deliver notation for each segment of the training session. Time shall be noted separately for classroom and field sessions. Total time shall equal "Session Duration" contained in the Instruction Overview Sheet.

(2) Session Text: Session text shall conform to the appropriate training outline for the trade group specified on the Cover Sheet (as applicable):

Operator Trade Group Training Outline

Introduction and training objectives

Equipment description

Safety Precautions

Preparation of equipment for operation

Startup procedures

Shut down procedures

Emergency shutdown procedures

Inspection of onsite equipment

Monitoring Requirements

Field Exercise /Hands on demonstration where applicable

Performance Evaluation

Trouble Shooting Procedures

Plant Maintenance Technician Training Outline

Introduction and training objectives

Equipment description

Safety Precautions

Equipment operating parameters

Preventive maintenance procedures

Equipment disassembly and reassembly procedures

Review of special maintenance tools and their uses

List of recommended lubricants

List of recommended spare parts

Field inspection of equipment

Field exercise /Hands on demonstration where applicable

Performance Evaluation

Final examination

Trouble Shooting Procedures

Electrician Training Outline

Introduction and training objectives

Equipment description

Safety Precautions

Equipment operating parameters

Preventive maintenance procedures

Equipment disassembly and reassembly procedures

Review of single line diagram

Review of electrical control schematics

Review of special maintenance tools and their uses

List of recommended spare parts

Field inspection of equipment

Field exercise / Hands on demonstration where applicable

Performance Evaluation

Final examination

Trouble Shooting Procedures

Electronics Technician Training Outline

Introduction and training objectives

Pre-examination

Equipment description

Safety Precautions

Equipment operating parameters

Preventive maintenance procedures

Equipment disassembly and reassembly

Review of P&IDs

Review of control loops

Review of electrical control schematics

Review of special maintenance tools and their uses

List of recommended spare parts

Field inspection of equipment

Field exercise / Hands on demonstration

Performance Evaluation

Final examination

Trouble Shooting Procedures

(3) Instructor Activity: Prompts for the instructor to aid in delivery of the training session. These prompts shall include but not be limited to display of audio visual materials, reference training handouts, questions to be posed and breaks in training.

d. Trainee Handouts: Trainee handouts shall be developed for each training session and trade group as specified on the Cover Sheet. Handouts shall be specific to equipment provided and of sufficient technical detail to support the trade group job description. All packages, regardless of trade group, shall contain a trainee handout outlining specific equipment and personnel safety precautions. The Design-Builder shall provide trainee handouts for each of the Owner's personnel participating in training.

e. Teaching Effectiveness Evaluation Standards: Performance evaluation standards shall be developed to determine if the training session successfully transmitted learning objectives to the Owner's personnel who will participate in the training. Unless otherwise directed by the Construction Manager, performance evaluation standards shall be prepared to dry test procedures, using colored tape and/or numbered tags to simulate the activity and sequence of events. In situations where it is not possible to demonstrate performance, written tests will be acceptable. Multiple choice, matching tables, and fill-in the blanks are all acceptable question formats. True and false questions shall not be submitted.

7. All test material shall be handled confidentially. Test results shall be provided to the Construction Manager at the conclusion of training session.

8. The Design-Builder shall furnish to the Construction Manager (4) identical sets of each Vendor Training Package. Each 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 inches.

9. Vendor Training Package shall be submitted in final form to the Construction Manager not later than the 50 percent of construction completion date. All discrepancies found by the Construction Manager in the Vendor Training Package shall be corrected within 30 days from the date of written notification by the Construction Manager.

10. Incomplete or unacceptable Vendor Training Package at the 50 percent construction completion point shall constitute sufficient justification to withhold the amount stipulated in Section 01700 from any monies due the Design-Builder.

11. The Design-Builder shall submit one copy of the final Vendor Training Package in an electronic media format. The information shall be provided on a 3 2 inch disk in either Word Perfect, Microsoft Word, or ASCII files when available.

ADD: 2-5.3.9 Electronic Document Submittal Requirements.

A. **General**

1. All final submittals are required in both paper and electronic format. Four (4) copies of each final submittal shall be provided on compact disk media (CD-ROM).
2. Where preliminary submittals are required in electronic format, three (3) copies of the preliminary submittal shall be provided on CD-ROM for review.
3. CD-ROM disks shall be on high-quality CD-R media. CDs shall have printed paper labels with the project name, CIP Number, Design-Builder, and content. CD-RW (CD-rewritable) disks are not acceptable. CDs shall be provided with a case and a case insert label displaying the same information shown on the CD label.
4. The CD-ROM data format shall comply with ISO 9660 (1988) with Joliet extensions.
5. Deviation from this standard will be accepted only if advance approval is given by the Construction Manager.

B. **Documents:** Electronic submittals for the following types of documents are required as a minimum. Additional requirements are identified in the equipment specifications.

1. Design
   (a) Design Specifications
   (b) Design Drawings and record drawings
2. Operations and Maintenance
   (a) Facility design O&M manuals
      1. Volume I - process information
      2. Volume II - standard operating procedures (SOP)
      3. Volume III - all maintenance information for the facility.
         (a) Manufacturer O&M manuals
         (b) Facility Loop and Wiring Diagrams
3. Training
   (a) Tutorials
   (b) Users manuals and guides
   (c) Simulation support
   (d) Classroom presentations
   (e) Classroom workbooks
   (f) Other related materials
4. Environmental Documents
5. Research & Development

C. **Format:**

1. Construction drawings and record drawings developed under the Contract shall be in Bentley Microstation (DGN) format. All drawings shall conform to the CADD and Drafting standards set forth in the CWP Guidelines, Volume III.

2. Other than construction drawings and record drawings, documents shall be in Adobe Acrobat PDF format, using the Acrobat version as specified by the Construction Manager. Documents that are submitted in Acrobat Image Only format will not be accepted.

3. Electronic Conversion: Vendor and Design-Builder shop drawings developed under the Contract shall be in Bentley Microstation (DGN) format. Documents in electronic format (WordPerfect, Microsoft Word, Excel, Lotus, etc.) shall be converted to standard PDF format using the Acrobat printer driver or other direct conversion software. The Acrobat PDF sub-format for electronically converted documents shall be the Acrobat Standard PDF file format which includes both image and text information.

4. Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) and converted into Adobe Acrobat (PDF). Image enhancement software shall be used during scanning. The Acrobat PDF sub-format for scanned documents shall be the Original Image with Hidden Text 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. Large documents shall be broken down by subsections to facilitate this requirement

D. **Document Organization and Indexing:**

1. Electronic submittals shall be logically organized. File names shall be in UPPERCASE only, use a maximum of 64 characters, contain no spaces, and clearly indicate the file contents.

2. Supplier's submittals that include O&M documentation for more than one equipment type shall be divided into separate documents for each equipment type.

3. Each document's Table of Contents shall contain PDF bookmarks which actively link to the referenced sections within the document.

4. A master PDF index file shall be included, with a master Table of Contents, and active internal links to individual document files. The master PDF index file shall be clearly identifiable. External PDF link file names shall be in uppercase only.

5. A table shall be provided and submitted in spreadsheet format which includes the information about each document file. The contents of the table shall be submitted and approved by the Construction Manager. An example of information to be provided is as follows: (This is an example only)

   (a) Document file name:

      1. Document title and description
      2. Hard Copy Catalog No. (used by facility document coordinator)
      3. Document Type: (see above)
      4. Facility Name
      5. Specification Number
      6. Process Name
      7. Unit Process Number
      8. Manufacturer's Name (if applicable)
      9. Supplier's Name (if applicable)

10. EMPAC asset number (if applicable)
11. Asset Description (if applicable)
    (a) Keyword
    (b) Qualifier

ADD: 2-5.3.10 Spare Parts List.

A. The Design-Builder shall furnish to the Construction Manager 5 identical sets 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. The Design-Builder shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be bound in standard size, 3-ring, looseleaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

ADD: 2-5.3.11 Record Drawings.

A. The Design-Builder shall keep and maintain, at the job site, one record set of Drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the WORK as actually constructed. These master record drawings of the Design-Builder's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the WORK.

   Copies of the record drawings shall be submitted on the 20th working day of every third month after the month in which the notice to proceed is given as well as on completion of WORK. Failure to submit complete record drawings on or before the 20th working day will enact the liquidated damages clause for interim record drawings submittals described in Article 3 of the Agreement.

B. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.

C. Record drawings shall be accessible to the Construction Manager at all times during the construction period.

D. Final payment will not be acted upon until the Design-Builder-prepared record drawings have been delivered to the Construction Manager. Said up-to-date record drawings shall be in the form of a set of prints with carefully plotted information overlaid in [red].

E. Upon substantial completion of the WORK and prior to final acceptance, the Design-Builder shall finalize and deliver a complete set of record drawings to the Construction Manager for transmittal to the Owner, conforming to the construction records of the Design-Builder. This set of drawings shall consist of corrected drawings showing the reported location of the WORK. The information submitted by the Design-Builder in the Record Drawings will be assumed to be correct, and the Design-Builder shall be responsible for the accuracy of such information, and for any errors or omissions which may appear on the Record Drawings as a result.

2-5.4.1 General. ADD the following:

Source Identification e.g., RFI numbers and Change Order numbers as required to identify the source of the change to the Contract Documents shall be noted.

2-5.4.2 Asset Specific Red-lines. To the City Supplements, item d), ADD the following:

- Dimensional changes to the drawings.
- Revisions to details shown on drawings.
- Depths of foundations below first floor.
- Locations and depths of underground utilities.
- Revisions to routing of piping and conduits.
- Revisions to electrical circuitry.
- Actual equipment locations.
- Duct size and routing.
- Locations of concealed internal utilities.
- Changes made by Change Order.
- Details not on original Plans.

ADD the following:

h) Slurry Seal and Asphalt Overlay Red-Lines: The Contractor shall clearly record on the City provided forms in MS Excel format the actual dates and quantity of each Bid item applied to each street segment and comments regarding each segment. The Contractor shall record reasons if no work is performed.

2-5.5 As-built Drawings. ADD the following:

As-built Drawings shall be the responsibility of the Contractor.

2-6 WORK TO BE DONE. ADD the following:

In accordance with the provisions of California Law, the Contractor shall possess or require the Subcontractor(s) to possess valid appropriate license(s) for the Work being performed.

2-9.2 Survey Services. DELETE in its entirety and SUBSTITUTE with the following:

The Contractor shall be responsible for all surveying services or as may be specified in these special provisions.

The payment for survey services shall be included in the various Bid items unless a Bid item for Survey Service has been provided.

2-10 AUTHORITY OF BOARD AND ENGINEER. ADD the following:

Regulating agencies of the City, such as Developmental Services, Fire and Planning Departments, enforce Legal Requirements and standards. These enforcement activities are not subject to the responsibilities of the Engineer under this Agreement.

2-11 INSPECTION. ADD the following:

The City may utilize field inspectors to assist the Engineer during construction in observing performance of the Contractor. The inspector is for the purpose of assisting the Engineer and shall not be confused with an inspector with a City regulatory agency or with a Special Inspector.

Code compliance testing (including all Geotechnical requirements) and inspections required by codes or ordinances, or by a plan approval authority, shall be the responsibility of and shall be paid by the Contractor, unless otherwise provided in the Contract Documents.

The Contractor's quality control testing and inspections shall be the sole responsibility of the Contractor and paid by the Contractor included in the Bid price.

2-14.2 Integration of the Work with Separate Contractors. To the City Supplement, ADD the following:

The Contractor shall prepare a plan in order to integrate the work performed by Separate Contractors, the City Forces, or both with the performance of the Work. The list of Separate Contractors includes:

1. City Forces

2-14.4 Use of Site. To the City Supplement, ADD the following:

The Design-Builder's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices. In order to facilitate the removal of existing centrifuges and installation of replacement centrifuges, the Design-Builder will be permitted to utilize the bridge crane at the project site. Design-Builder's use of the bridge crane shall be subject to the following conditions:

1. The Design-Builder shall coordinate the use of the bridge crane by providing the Owner with a written request at least 48 hours in advance of the anticipated use
2. Should unforeseen events occur, the Owner shall have priority in the use of the bridge crane
3. The Design-Builder shall provide proof that his staff has been properly trained in the use of the bridge crane. Only trained staff shall be allowed to operate the crane.
4. The Owner makes no guarantees as to the condition of the bridge crane. The Design-Builder assumes sole responsibility for any and all damage or injury caused to Owner's equipment, property or personnel resulting from the use of the bridge crane. The Design-Builder shall adjust his insurance limits as recommended by the Owner's attorney or authorized representative.
5. The Design-Builder shall provide his own equipment harnesses and associated lifting hardware for use with the bridge crane
6. Should the Design-Builder's use of the crane cause breakdown or failure, he shall be responsible for coordinating and paying for repairs. The repairs shall be performed by a Contractor who is currently contracted with the Owner to provide such repair and maintenance service. The Design-Builder shall ensure that repairs be completed and the bridge crane is restored to service no later than one day, unless otherwise agreed with City at the time of breakdown.

ADD: 2-17 CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM.

1. Prior to the Award of Contract or each Task Order, you and your Subcontractors and Suppliers must register with Prism®, the City's web-based contract compliance portal at:

   http://pro.prismcompliance.com/default.aspx.

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.

SECTION 3 – CHANGES IN WORK

3-3.2.2 Basis for Establishing Costs. To the City Supplement, a) Labor, first and second paragraphs, DELETE in their entirety and SUBSTITUTE with the following:

The City reserves the right to request financial records of salaries for an employee, wages, bonuses and deductions to substantiate the actual cost of labor certified by a California licensed Certified Public Accountant. The Contractor shall use the City provided form i.e., "PUBLIC WORKS PAYROLL REPORTING FORM" which is available at http://www.sandiego.gov/eoc/pdf/payrollreport.pdf to list the labor rates of its personnel and Subcontractors who work on this Project. An initial submittal shall be made prior to NTP.

The payment for payroll records shall be included in the various Bid item unless a separate Bid item has been provided.

SECTION 4 - CONTROL OF MATERIALS

4-1.3.1 General. First paragraph, ADD the following:

Other standard items or materials typically accepted by Certificate of Compliance shall not require inspection at the source unless specified in the Special Provisions. For a list of these items or materials, the Contractor may refer to the Contract Documents.

4-1.3.5 Special Inspections. To the City Supplement, ADD the following:

Special Inspection and testing by the Special Inspectors shall meet the minimum requirements of the prevailing Codes and by the City's Development Services Department (DSD) and reference in http://www.sandiego.gov/development-services/industry/special.shtml

4-1.5 Certificates of Compliance. DELETE in its entirety and SUBSTITUTE with the following:

Certificates of Compliance shall be furnished to the Engineer prior to the use of any material or assembled material for which these Specifications so require or if so required by the Engineer.

The Engineer may waive the materials testing requirements of the Specifications and accept a Certificate of Compliance. Manufacturing test data may be required by the Engineer to be included with the submittal.

Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The submission of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents, and any material not conforming to the requirements will be subject to rejection whether in place or not.

When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the City shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

4-1.6 Trade Names or Equals. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. Unless stated otherwise, materials or equipment of other Suppliers may be accepted if sufficient information is submitted to the Engineer for review to determine whether the material or equipment proposed is equivalent or equal to that named.

a) The Contractor shall submit its list of proposed substitutions for "an equal" ("or equal") item(s) **no less than 15 Working Days prior to Bid due date/no later than 5 Working Days after the determination of the Apparent Low Bidder** and on a City form when provided by the City.

   i. The City will respond to the Contractor's substitution proposal by at least 3 Working Days prior to the Bid due date. If the City fails to respond to the Contractor's substitution proposal within the specified time period, the substitution proposal will be deemed denied.

   ii. The Contractor may bring forward a substitution proposal after Award that was denied based on the City's failure to respond by submitting a "Cost Reduction Proposal" in accordance with 3-1.3.

b) The request for substitution shall include the following information:

   i. Whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.

   ii. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

   iii. All variations of the proposed substitute from the items originally specified will be identified.

   iv. Available maintenance, repair, and replacement service requirements. 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.

   v. Certification that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as that specified.

c) There is no guaranteed time frame for the City's review of the substitution requests.

d) The burden of proof as to the type, function, and quality of any such substitute product, material or equipment shall be upon the Contractor. The Engineer may require at the Contractor's expense additional data about the proposed substitute.

e) If the Engineer takes no exceptions to the proposed substitution, it shall not relieve the Contractor from responsibility for the efficiency, sufficiency, quality, and performance of the substitute material or equipment, in the same manner and degree as the material and equipment specified by name.

f) The lack of action(s) on the Engineer's side within the Contractor's requested time shall not constitute acceptance of the substitution.

g) Acceptance by the Engineer of a substitute item shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents.

h) For the substitution review process or to have materials listed on the AML, refer to the AML standard review process.

i) The Bid/Proposal shall be based on the material and equipment specified by name in the Contract. If the proposal is rejected by the Engineer, the Contractor shall not be entitled to either an extension in Contract Time, increase in the Contract Price, or both.

j) As applicable, no Shop Drawing or Working Drawing submittals shall be made for a substitute item nor shall any substitute item be ordered, installed, or utilized without the Engineer's prior written.

k) The Contractor shall reimburse the City for the charges of the Engineer for evaluating each proposed substitute.

l) For Design-Build contracts, one copy of all designer reviewed submittals shall be provided to the Engineer.

ADD: 4-2 Quality Control.

4-2.1 Definition. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

4-2.1 Project Quality Control Plan.

A. The Design-Builder is responsible for producing WORK to meet the quality required by the Contract Documents and to perform the quality control efforts necessary to ensure those requirements are met. The Construction Manager's inspection of any WORK will not relieve the Design-Builder of the primary responsibility for such efforts.

B. The Design-Builder shall submit to the Construction Manager a Quality Control Plan for review and approval within 21 days of the Notice to Proceed. The submittal must be approved before construction WORK begins. The Quality Control Plan will include:

1. A description of the workings and structure of the Design-Builder's Quality Control Plan that will be implemented to assure quality WORK will be done.

2. A contract specific Inspection Plan that lists and describes the inspections that the Design-Builder will conduct, their frequency, acceptance criteria, and who will conduct each inspection. The Inspection Plan shall include the WORK to be performed by subcontractors, fabricators, and suppliers.

3. Identification of the individuals within the Design-Builder's organization who are responsible for quality assurance including their role and authority.

After completion of the Construction Manager's review of the Design-Builder's Quality Control Plan, the Design-Builder and Construction Manager will meet to discuss and define quality standards and expectations and to coordinate the Construction Manager's inspection efforts with the Design-Builder's planned efforts.

C. The Design-Builder's attention is directed to the Check Out Plan required by Section 6-8. At the Design-Builder's option, the Physical Checkout and Inspection portion of the Check Out Plan may be addressed in the Project Quality Control Plan as long as all elements of the Check Out Plan are addressed in the Project Quality Control Plan.

D. The Design-Builder will be obligated to accommodate procedural changes to contract required quality control issues requested by the Construction Manager.

4-2.3 Factory Inspection and Tests.

A. The Design-Builder shall be responsible for inspection and testing of materials, products, or equipment at the place of manufacture at its own expense when required by the General Conditions, Special Provisions, Regulatory Permits, Codes, or as noted in the plans or specifications. Where specified in the plans and/or technical specifications, the Owner/Construction Manager will perform inspection and witness tests on materials, products, or equipment at the place of manufacture. The Design-Builder shall bear all costs for inspection and for witnessing factory tests by the Owner's/Construction Manager's representatives as nominated by the Owner for the number of days indicated for such inspections and observations. These costs shall include travel expenses, and expenses for lodging, meals, and car rental if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. If air travel is involved, it shall include economy class tickets. Costs paid by the Design-Builder for inspection and for witnessing factory tests shall not include the salaries or salary-related expenses of the inspectors.

B. Where the Plans and/or Technical Specifications indicate that factory inspection and witnessing of testing by the Owner/Construction Manager is optional or discretionary, the Owner will pay for travel and related costs associated with such inspection and witnessing of tests by the Owner's/Construction Manager's representatives.

C. The presence of the Owner's/Construction Manager's representatives at the place of manufacture shall not relieve the Design-Builder of the responsibility for furnishing materials, products, and equipment which comply with all requirements of the Contract Documents. The Design-Builder is obligated to meet the requirements of the Contract Documents, and any act or omission on the part of the Owner/Construction Manager shall not relieve the Design-Builder of the obligation to fulfill the requirements of its Contract.

D. In cases, where the Owner/Construction Manager is indicated to perform inspection and witness tests, the Design-Builder shall provide the Construction Manager, as a minimum, an advance notice of fourteen (14) calendar days prior to the start of any testing at the place of manufacture. This notice period may be modified depending on the requirements of each specification section in the technical specifications of the Contract Documents.

E. When tests fail to meet the specified requirements, retesting because of non-conformance to specified requirements shall be performed by the same testing laboratory as directed by the Owner/Construction Manager. The Design-Builder shall bear all costs for such retesting, including costs for additional trips for factory inspection and testing by Owner's/Construction Manager's inspectors.

F. For samples and tests required by the Design-Builder for its own quality assurance program and needs, whether or not specified in the Contract Documents, costs shall be included in the Contract Price.

G. All tests required by the specifications, regulatory permits, or referenced codes and standards shall be the responsibility of the Design-Builder, unless specifically noted otherwise.

4-2.4 Sampling and Testing.

A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the material, product, or equipment considered; however, the Owner will use any generally-accepted system of sampling and testing which will insure that the quality of the workmanship is in full agreement with the Contract Documents.

B. Any waiver by the Owner of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the Construction Manager will make independent investigations and tests; and failure of any portion of the WORK to meet any of the requirements of the Contract Documents shall be reasonable cause for the Construction Manager to require the removal or correction and reconstruction of any such work in accordance with the Contract Documents.

4-2.5 Inspection and Testing Laboratory Service.

A. The Owner will provide and pay for the services of an independent testing laboratory to perform routine testing of earth work and concrete at the site, (i.e. soil density, concrete strength, slump, and air content) and perform random tests of other areas previously completed and inspected by Design-Builder.

B. The Owner's testing laboratory will perform other inspections, testings, and other services specified in the Contract Documents, to be performed by the Owner, or as required by the Construction Manager. The cost of these services will be paid for by the Owner.

C. Reports will be submitted by the Owner's testing laboratory to the Construction Manager in duplicate, indicating observations and results of tests, and indicating compliance or non-compliance with Contract Documents.

D. The Design-Builder shall cooperate with the Construction Manager and Owner's testing laboratory by furnishing samples of materials, concrete design mix, equipment, tools, storage and other assistance as requested.

E. The Design-Builder shall notify the Construction Manager 24 hours prior to the expected time for operations requiring inspection and laboratory testing services.

F. Retesting required because of non-conformance to specified requirements shall be performed by the same testing laboratory as directed by the Construction Manager. The Design-Builder shall bear all costs from such retesting at no additional cost to the Owner.

G. For samples and tests required for the Design-Builder's use, the Design-Builder shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the Design-Builder's use shall be included in the Contract Price.

H. All tests required by the specifications or referenced codes and standards are the responsibility of the Design-Builder, unless specifically noted otherwise.

4-2.6 Installation.

A. **Inspection**: The Design-Builder shall inspect materials or equipment upon arrival on the job site and immediately prior to installation. The Design-Builder shall reject damaged and defective items. This inspection shall include a review of Contract requirements; a check to assure that all materials and/or equipment have been tested, submitted, and approved; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to reviewed shop drawings or submittal data. This inspection shall also include instruction as necessary to assure that workmen know the requirements of the Contract as they pertain to the feature, an examination of the quality of workmanship, as well as a review of control testing for compliance with the Contract requirements.

B. **Measurements**: The Design-Builder shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. **Special Procedures:** Methods and facilities shall be provided to assure conformance with requirements for special process specifications such as welding, heat treating and nondestructive testing of materials. Certifications for personnel, procedures, and equipment shall be maintained as required to meet the requirement of the Contract Documents and all applicable codes.

D. **Manufacturer's Instructions**: Where installations include manufactured products, the Design-Builder shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

4-2.7 Manufacturer's Field Installation Services and Reports.

A. When specified in individual specification sections, the Design-Builder shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, (test, adjust, and balance of equipment) and to provide instructions when necessary.

B. The Design-Builder shall report to the Construction Manager in writing any observations and site decisions or instructions given by the manufacturers' representative to the Design-Builder that are supplemental or contrary to manufacturers' written instructions.

C. The Design-Builder shall submit manufacturer representative's reports (in duplicate) within 10 days of each field visit, to the Construction Manager for review. If duration of field visit is greater than one week, submit weekly reports. The final report shall certify that equipment or system has been satisfactorily installed and is functioning correctly.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

6-1.2 Commencement of Work. To the GREENBOOK and the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Unless specified otherwise, construction shall start within 5 Working Days after NTP and be diligently prosecuted to completion within the Contract Time. The Contractor shall not start any construction activity at the Site until the Pre-construction Meeting is held and the NTP has been issued by the Engineer.

Upon the Contractor's written request, the City may delay the NTP as follows:

a) Up to 5 Working Days from the Pre-construction Meeting, or

b) Up to 40 Working Days from the Limited NTP for the preparation, submittal, obtaining approval for and filing of the PRDs in accordance with 801, "STORM WATER POLLUTION CONTROL," or

c) Up to 60 Working Days from the Limited NTP for the preparation, submittal, and approval of the TCP on "D-sheets" when specified in 7-10.2, "Traffic Control."

The Contractor shall notify SDG&E at least 10 Working Days prior to excavating within 10' of SDG&E Underground High Voltage Transmission Power Lines (i.e., 69 KV and higher).

For areas that do not require engineered TCP on D-sheets, the Contractor may at any time after the Pre-construction Meeting obtain a TCP Permit via Working Drawings or the City's over the counter process and start the Work. If the Contractor decides to commence the construction work before the completion of the D-sheet TCPs, the Contractor shall forfeit the 60 Working Days specified here. The D-sheet TCP shall be done concurrently and no additional time will be granted.

For the Design-Build contracts, the Design-Builder shall not begin construction of the Project or any portions thereof until the Engineer approves the design for the Project or portion thereof. No payment shall be made for any construction Work performed prior to the Engineer's approval. Applications for payment for such work shall not be binding on the City.

6-1.4 Phased Funding. To the City Supplement, ADD the following:

This contract is subject to Phased Funding.

ADD: 6-1.8 Pre-construction Meeting. Within 20 Working Days from the Limited NTP the Engineer will schedule a mandatory pre-construction meeting (Pre-construction Meeting) with the Contractor. The agenda will include items such as NTP, design services and submittal and review process for Design-Build contracts, critical elements of the work schedule, submittal schedule, cost breakdown of major lump sum items, payment requests and processing, environmental and community concerns, coordination with the involved utility firms, the level of record project documents required and emergency telephone numbers for all representatives involved in the course of construction.

ADD: 6-8.1 Completion. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.1 Completion. The Contractor shall submit a written assertion that the Work has been completed. If, in the Engineer's judgment, the Work has been completed in accordance with the Contract Documents, the Engineer will set forth in writing the date the Work was completed. This will be the date when the Contractor is relieved from responsibility to protect and maintain the Work.

6-8.2 Acceptance. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.2 Acceptance. Acceptance will occur after all of the requirements contained in the Contract Documents have been fulfilled. If, in the Engineer's judgment, the Contractor has fully performed the Contract, the Engineer will accept the Contractor's performance of the Contract.

6-8.2.1 Equipment Testing and Startup.

Equipment testing and plant startup are requisite to satisfactory completion of the contract and, therefore, shall be completed within the contract time.

A. The Design-Builder shall provide the services of an experienced and authorized representative of the manufacturer of each item of equipment indicated in the equipment schedules (excluding manually-operated valves smaller than 24 inches in size, injectors, tanks, batch-type disc meters, and rotameters, and any other minor items of equipment specifically exempted by the Construction Manager in writing), who shall visit the site of the WORK and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the Design-Builder shall arrange to have the manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to the Construction Manager.

B. The Design-Builder shall require that each manufacturer's representative furnish to the Construction Manager a written report addressed to the Owner certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated satisfactorily under full-load conditions.

C. The Design-Builder shall be responsible for scheduling all operations testing. The Design-Builder is advised that the Construction Manager and the Owner's operating personnel will witness operations testing and that the manufacturer's representative shall be required to instruct the Owner's operating personnel in correct operation and maintenance procedures. Such instruction shall be scheduled at a time arranged with the Owner at least 2 weeks in advance and shall be provided while the respective manufacturer's equipment is fully

operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. Prior to scheduling any operations testing, the Design-Builder shall have previously furnished the Owner's Manuals required under Section 01300.

D. The Design-Builder shall notify the Construction Manager at least 3 days in advance of each equipment test.

E. The Design-Builder shall furnish all personnel, power, water, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting the tests.

6-8.2.2 Plant Startup.

A. Startup shall not be commenced until all required equipment tests, where indicated in the specifications, have been completed to the satisfaction of the Construction Manager.

B. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the Design-Builder. Time lost for equipment repairs, wiring corrections, control point settings, or other reasons which actually interrupt the startup may, at the discretion of the Construction Manager, be justifiable cause for extending the startup test duration.

C. During the startup, the Design-Builder shall provide the services of authorized representatives of the manufacturers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

D. During the startup, the Design-Builder shall keep records of the operations, in accordance with the instructions of the Construction Manager.

6-8.2.3 Physical Checkout, Shop, Field, and Functional Testing.

A. The physical inspection and testing requirements in this Section are in addition to those requirements defined in Division 2 through 16 of the Technical Specifications. These activities shall be performed prior to substantial completion.

B. Provide the following checkout and testing activities:

1. Shop Testing of equipment as specified in Divisions 2 through 16 and as specified herein.
2. Physical checkout and inspection of equipment and materials to verify conformance of the installed equipment and materials to the Contract Document.
3. Field Testing of equipment as specified in Divisions 2 through 16 and as specified herein.
4. System Loop Checks as specified in Divisions 2 through 16 and as specified herein.
5. Functional Testing of equipment as specified in Divisions 2 through 16 and as specified herein.

C. Provide a Checkout Plan covering the entire checkout and testing process in conformance with the Contract Documents, and as specified herein.

6-8.2.3.1 Definitions.

A. Shop Testing is defined as testing that is done by the Supplier either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the products meet the requirements of the pertinent technical specification(s). The administrative procedures for shop testing are

specified in subsection 6-8.2.3.4, while the technical requirements are included in the pertinent technical specification(s). The minimum acceptable test criteria are specified in subsection 6-8.2.3.3.

B. Physical Checkout is defined as the process of physically inspecting products after they have been installed to determine if the products have been properly and completely installed, comply with the approved shop drawings and are ready for Field and/or Functional Testing. The requirements for Physical Checkout (if applicable) are contained in the pertinent technical specifications and in subsection 6-8.2.3.7.

C. Field Testing is defined as testing that is performed by the Design-Builder, and/or Subcontractors, with Supplier assistance, on products after they have been installed, and after the performance of physical checkout, for the purpose of proving that the tested products meet the requirements of the pertinent technical specifications. Field testing is required regardless of whether or not shop testing was performed on the same piece of equipment or material. The administrative requirements for field testing are specified in subsection 6-8.2.3.8, while the technical requirements are contained in the pertinent technical specification(s). The minimum acceptable test criteria are specified in subsection 6-8.2.3.3.

D. System Loop Checks - (Applies to equipment or systems controlled by the Distributed Control System) are defined as tests performed jointly by the Design-Builder and the Control Systems Provider providing control systems (COMNET), to verify the control wiring (both hardwired and datalink) between the Distributed Control System and instruments or equipment which it monitors or controls throughout the plant. Loop checks are to be performed to insure the Distributed Control System can properly control or monitor each instrument or piece of equipment and that the systems are ready for functional testing. The requirements and procedures for Loop Checks are contained in the pertinent specifications and subsection 6-8.2.3.9.

Loop Checks are defined as tests performed to verify the control wiring (both hardwired and datalink) between local control panels (LCPs) and/or the distributed control system (DCS) and instruments or equipment which they control. The Design-Builder performs loop checks from local control panels to all instruments or equipment which they control. Additionally the Design-Builder shall perform loop checks jointly with the Control Systems Provider (CSP) Contractor, for instruments or equipment controlled by the distributed control system. The test verifies proper operational control or monitoring of the instrument or equipment. Loop checks are to be performed to insure the LCP and/or the DCS can properly control or monitor each instrument or piece of equipment and that the systems are ready for functional testing. The requirements and procedures for System Loop Checks are contained in the pertinent specifications and subsection 6-8.2.3.9.

E. Functional Testing is defined as testing performed by the Design-Builder on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed, and after Physical Checkout and Field Testing have been completed, for the purpose of proving that the system meets requirements as specified and as indicated. The administrative requirements for Functional Testing are specified in subsection 6-8.2.3.10, while the technical requirements are specified in the technical specifications, and the systems are listed in 6-8.2.3.14, if applicable.

F. The Supplier's Representative or Manufacturer's Representative is defined as a person, or persons provided by the Supplier or Manufacturer, who is qualified by having the training and experience, to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the products provided by that same Supplier. The

Supplier's Representative or Manufacturer's Representative shall be a Professional Engineer registered in the State of California in the discipline most appropriate for the product provided or approved by the Owner.

G. The Testing, Checkout, and Start-Up Coordinator is defined as the person provided by the Design-Builder to coordinate and oversee the total spectrum of testing and inspection activities required by the Contract Documents. The Testing and Checkout and Start-Up Coordinator shall be a Professional Engineer registered in the State of California in the discipline most appropriate for the equipment to be tested and checked out or approved by the Owner.

6-8.2.3.2 Roles and Responsibilities.

A. The Design-Builder shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein and interim connections. In addition the Design-Builder shall arrange for and provide the participation or assistance of survey crews, engineers, quality control technicians, Suppliers' and/or Manufacturer's representative(s), and required utility, regulator, or governmental agency representatives.

B. The Design-Builder shall provide the services of the Supplier's and/or Manufacturer's representative(s) as follows:

1. Shop Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
2. Assistance during installation as specified in the specifications in Divisions 2 through 16.
3. Field Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
4. Functional Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.

C. The Supplier's and/or Manufacturer's representative's activities required by this Section are in addition to the requirements for vendor training and other services specified elsewhere in the Contract Documents. Timing for the performance of these services shall be defined in the Checkout Plan, specified herein.

D. The Construction Manager and/or Owner may review and comment on the Design-Builder's deliverables, participate in the physical inspection activities, witness the shop and field testing, witness loop checks, witness functional testing, and provide verification of conformance to the specifications.

E. The Design-Builder shall be responsible for incorporating these procedures into the CPM schedule. No additional time or compensation will be approved relating to delays associated with these requirements.

6-8.2.3.3 Minimum Shop and Field Testing Requirements. In addition to procedures referenced for shop and field testing contained in a technical specification, the following shall be required. Should these requirements conflict with the Supplier's recommendations in any way, the more stringent requirements will prevail.

A. Measurement of wearing ring clearances for all pumps requiring assembly, so equipped:

1. Provide a minimum of two measurements of clearances taken opposed to each other by 90°.
2. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck rings found to be out of round or out of specified tolerance.

B. Measurement of Impeller Bore for all pumps requiring assembly:

1. Provide a minimum of two measurements of the Impeller Bore opposed to each other by 90°.
2. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck impellers found to be out of round or out of specified tolerance.

C. Measurement of shaft run out for all rotating equipment requiring assembly:

1. Remove bearings from the shaft. Support shaft on pedestal rollers or in a lathe.
2. Check each shoulder on the shaft.
3. Take a minimum of two measurements of each shoulder, opposed to each other by 90°.
4. All measurements and clearances shall be within Supplier's specifications for new installations. Replace and recheck shafts found to be out of round or out of specified tolerance.

D. Vibration Measurement:

1. Conduct a torsional and vibration analysis of equipment in accordance with the requirements of Technical Specifications Section 11000 and the applicable Technical Specifications for the equipment.

E. Belt Drives:

1. All belts shall ride within the sheave and not slip to the bottom of the groove(s).
2. Belt tension shall be in accordance with Supplier's recommendations.
3. Pulley alignment shall be within Supplier's recommendations.

F. Gear Drives and Reducers:

1. Check gears for lash at no less than three points around the gear.
2. Rotate gears a full 360° while checking alignment.

G. Coupling/Shaft Alignment:

1. Perform all final alignments and checks with a dial indicator or a laser device. Feeler gauges and straight edges are not acceptable.
2. Eliminate soft foot conditions prior to aligning.
3. When checking for final soft foot, any displacement in excess of 0.002" must be corrected.
4. When checking for pipe strain, any displacement in excess of 0.002" must be corrected.
5. Alignments will not be regarded as final until the grout is set and all piping has been attached. Demonstrate that alignment is not changed by attachment of piping.
6. Shim the driving element, never the driven element.
7. Take bracket sag corrections into account when using a dial indicator. Bracket sag shall be determined on a rigid pipe.
8. Mount a dial indicator to the driven element so that it can be rotated. Rotate both elements while aligning.
9. When aligning three coupled elements, align gear reduction elements with the driven element first, then align the driver to the gear reduction element.
10. Check all four alignments; i.e., angular alignment in the vertical and horizontal planes, and parallel alignment in the vertical and horizontal planes.

11. The minimum acceptable alignment accuracy for flexible couplings is ±0.005", or the Supplier's specifications, whichever is more stringent.
12. The dial indicator must be perpendicular to the alignment surface.
13. Number hold down nuts prior to tightening. Loosen in reverse order. Tighten in ascending order.
14. Use only clean, deburred shims. Clean the machine base and feet from rust or burrs prior to alignment.

H. Measurement of Noise (dB)

1. Eliminate noise sources generated by adjacent construction activity prior to testing.
2. Establish a background noise level prior to testing.
3. Perform noise level testing whenever a maximum noise level is indicated. A noise test will also be required for any equipment likely to exceed OSHA standards for one hour exposure without hearing protection.

I. Hydrostatic Testing:

1. AWWA C600 standards latest edition are the minimum acceptable standards for all hydrostatic testing.
2. Visually inspect all welds prior to testing, for cracks, undercut on surface greater than 1/32" deep, lack of fusion on surface, reinforcement greater than specified in Table 127.4.2 located in ANSI B31.1 Power Piping, and incomplete penetration (when accessible). Repair or rework as directed by the Construction Manager.
3. At no time during hydrostatic testing shall any part of the piping system be subjected to a stress greater than 90% of its yield strength at test temperature.
4. After at least 10 minutes of full hydrostatic test pressures, make an examination for leakage of all joints, connections, and all regions of high stress, such as around openings and thickness transition sections.
5. Unless otherwise specified, the minimum required hydrostatic test pressure shall be 1.5 times the design pressure as specified and as indicated.
6. Unless otherwise specified, the minimum pressure holding time shall be 10 minutes plus the time required to inspect for leakage.
7. Maximum pressure shall not exceed the maximum rated pressure for any component in the system being tested.

J. Electrical Equipment

1. The testing standards for electrical components are those contained in the pertinent technical specification(s) and in pertinent technical specification(s) in Attachment A.
2. Functional and field testing shall follow the Physical Checkout and are contained in the pertinent technical specification(s), and systems to be functionally tested are listed in 6-8.2.3.14.

6-8.2.3.4 Shop Testing.

A. When required by the Technical Specifications, perform shop testing prior to delivery of the equipment or material. Unless otherwise noted, provide 45 days written notice indicating the time and place of testing. The Design-Builder shall submit the following for approval thirty days prior to this notice:

1. Description of the equipment and the applicable specification sections
2. **Description of the test:** Specifically outlining how tests will conform to the requirements in the Technical Specifications.
3. **Testing Devices That Will Be Used in the Tests:** Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.
4. **Personnel Used to Perform the Tests:** Resumes, qualifications, and experience shall be submitted. Personnel performing tests shall be Professional Engineers registered in the discipline most appropriate for the testing that will be performed.
5. **Schedule for testing:** Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.
6. **Test forms:** Submit all forms used to record and report on Shop Test data, for approval, prior to the test. No testing shall be conducted until these forms are approved. Forms shall provide the following information: description of test, equipment used, personnel present, equipment specification numbers, and measurements made. Forms shall have a place for signature by the person responsible for conducting the test, and an officer of the company verifying that the tests performed are true, accurate, have met the required criteria, and that the equipment will operate as indicated and as specified.

B. Shop test procedures will be reviewed and returned by the Construction Manager within 30 days of receipt. Incorporate minor comments related to the procedures, equipment, or personnel prior to testing. Major comments by the Construction Manager will require a resubmission of the shop test procedure and proposed test date. The Design-Builder will be notified, in writing by the Construction Manager, if a formal resubmission is required with the transmittal of the review comments.

C. Travel, lodging, rental car, meals, and other travel related expenses for the Construction Manager, Owner personnel, and their representatives, prior to, during, and after the testing, will be paid for by the Design-Builder.

D. Submit 6 (six) copies of the following within seven days after completion of the tests for approval:

1. Completed test forms, for each device tested, on forms as approved prior to the test.
2. Completed certification, the content of which was approved prior to the tests.
3. A written summary of test; a report of the results and a summary of the entire procedure.
4. A schedule for retesting, if necessary. The Design-Builder shall perform any retesting required to fulfill the intent of the Technical Specification test requirements at no additional cost to the Owner. Additional travel required by the Construction Manager and the Owner personnel and their representatives to witness retesting shall be paid by the Design-Builder. Reimbursement for travel expenses required for retesting will be applied as a debit against the Design-Builder's subsequent Application for Payment. Allowable travel cost will be in accordance with the travel expenses reimbursements permitted by City regulations.

6-8.2.3.5 Witnessing of Tests. Unless otherwise noted, provide a minimum of 45 days written notice to the Construction Manager so that the Construction Manager, the Owner, or its representatives may have the opportunity to witness the Shop tests, Field tests, Loop checks, and Functional tests. The Construction Manager and the Owner may witness the performance of any or all tests, at their option.

The Construction Manager's or Owner's witnessing of tests does not relieve the Design-Builder of its obligation to comply with the requirements of the Contract Documents.

6-8.2.3.6 Checkout Plan.

A. The Design-Builder shall submit a Checkout Plan based upon the requirements defined herein, and the Technical Specifications to the Construction Manager. Six (6) copies and 1 (one) copy on electronic media (Microsoft Word) of the preliminary Checkout Plan shall be submitted for review within 270 days of the Notice to Proceed or 90 days prior to the proposed date of the first test, whichever occurs first. The plan shall define:

1. The equipment and applicable specification section(s) for the equipment
2. The logical and systematic performance of physical inspections, shop tests, field tests, loop checks, and functional tests including:
    a. A chronological schedule of all testing, checking, and inspection activities.
    b. A checklist of all inspection, checking, and testing activities broken down by location, discipline, system, and device or item.
    c. All blank forms proposed by the Design-Builder for verification or recording for all testing.
    d. An index which cross references the forms to their intended application(s).
    e. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for re-testing, in the event it is required.
3. Participants in the testing.
4. Special test equipment.
5. Sources of the test media (water, power, air).
6. The proposed method of delivery of the media to the equipment to be tested.
7. Temporary or interim connections for the sequencing of multiple units.
8. Ultimate proper disposal of the test media.

B. The plan will be reviewed by the Construction Manager, modified or revised within 90 days as necessary by the Design-Builder, then approved by the Construction Manager. The Design-Builder shall continue to update the Checkout Plan, working in conjunction with the Construction Manager prior to the start of the scheduled equipment checkout and functional testing activities. Each specific element of the plan must receive written approval by the Construction Manager at least two weeks prior to the actual commencement of testing.

C. The Design-Builder shall designate, in the Checkout Plan, a coordinator for Testing, Checkout, and Start-Up to coordinate and manage the activities defined in the checkout plan, as approved by the Construction Manager.

6-8.2.3.7 Physical Checkout and Inspections.

A. Physical Checkout and inspections provide verification of conformance to the requirements of the Technical Specifications and Contract Drawings for physical presence; dimensions; and location, for proper materials, parts, and items; and for integrity of materials, equipment and systems to determine their condition and readiness for field and/or functional testing. Inspection includes the following elements, as applicable

1. Exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, gates, and signage.
2. Building structural integrity, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC systems.
3. Concrete structures for structural integrity, finish, tolerance, durability, appearance, embedded and inserted items, painting and surface applications.
4. Steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.
5. Mechanical systems and items for installation, alignment and securing, adjustments of packing and seals, lubrication, drive connection and alignment, motor rotation, belt/chain tension, painting or surface applications, and tagging for identification.
6. Piping systems for material, size, components, direction, alignment of joints and bolting/welding, valves, packing and seals, screens, filters and strainers, painting, identification labeling and color coding, hangers, anchors, supports, and expansion provisions.
7. Electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit identification, terminal installation and identification, major switches, circuit breakers and components, and labeling for system identification.
8. Communication systems including telephone, fire/smoke alarm, security, page/party, and closed circuit TV; similar to electrical above.
9. Computer systems by station, function, and network interface.

B. Inspection will verify that tanks, pipes, conduits, vessels, equipment, systems, buildings, areas and other items provided under the Contract are clean and free from debris or materials which may interfere with subsequent testing requirements or routine operations. Correct unsatisfactory conditions prior to testing or acceptance.

C. Upon completion of the inspection, submit to the Construction Manager six copies of each completed inspection form, signed by an authorized representative of the Design-Builder who participated in the inspection. The Construction Manager will review and approve the contents of the forms. Should a reinspection be required, it shall be performed at no additional cost to the Owner.

6-8.2.3.8 Field Testing of Equipment.

A. **Design-Builder Personnel:** The Design-Builder shall provide the services of an experienced and authorized Supplier's or Manufacturer's representative for each item of equipment indicated in the equipment schedules (excluding manually-operated valves smaller than 24-inches in size, injectors, tanks, batch-type disc meters, and rotometers, and any other minor items of equipment specifically exempted in writing by the Construction Manager and DESIGNER), who shall visit the site of the WORK and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the Design-Builder shall arrange to have the Supplier's or Manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to the Construction Manager. The Design-Builder shall notify the Construction Manager of the visit of the Supplier's or Manufacturer's representative at least 48 hours in advance of arrival at the work site.

B. **Design-Builder's Report:** The Design-Builder shall deliver to the Construction Manager a written report prepared by the Supplier's or Manufacturer's representative, addressed to the Owner, certifying that the equipment has been properly installed and lubricated, is in accurate

alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated satisfactorily under full-load conditions. The Supplier's or Manufacturer's representative shall also provide written authorization that the equipment can be operated. This report shall be submitted within 7 days of the Supplier's or Manufacturer's representative visit to the site.

C. **Scheduling Tests:** The Design-Builder shall be responsible for scheduling all field testing. The Design-Builder is advised that the Construction Manager and the Owner's operating personnel will witness field testing and that the Supplier's or Manufacturer's representative shall be required to instruct the Owner's operating personnel in the correct operation and maintenance procedures. Such instruction shall be scheduled at a time arranged with the Owner at least 2 weeks in advance, and shall be provided while the equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. One hundred and twenty (120) days prior to scheduling any field testing, the Design-Builder shall have previously received approval of the Owner's Manuals required under Section 01300. No field testing will be permitted if this requirement is not met. Any associated delays to the completion of the contract resulting from delayed testing due to incomplete or unapproved Owner's manuals will be the responsibility of the Design-Builder.

D. **Test Support:** The Design-Builder shall furnish all personnel, power, water, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, temporary and interim connections, and services required for conducting the tests and shall properly dispose of all material, media, and lubricants upon completion of the test.

F. **Notice Requirement:** Field testing shall be in addition to, and not in lieu of, shop testing. Field testing will be performed as a part of the overall physical and functional testing process defined herein and in accordance with the approved Checkout Plan. However, as a minimum the following specific instructions shall also apply. The Design-Builder shall provide 60 (sixty) calendar days written notice indicating the date and time for testing each piece of equipment, or a series of equipment pieces.

1. All equipment installed by the Design-Builder shall undergo an operational check by the Design-Builder to verify that the equipment is functioning (electrically, mechanically and structurally) as it has been designed.

2. Each device shall be operated through its full range of motion and each instrument shall be checked against its full span.

3. At a minimum, this check shall include turning the equipment on and running it through one full cycle. This cycle shall include all operating possibilities. Signals or interlocks from other pieces of equipment may be simulated upon prior approval of the Construction Manager.

G. **Review of Procedures:** Field test procedures will be reviewed and returned by the Construction Manager within 30 (thirty) days of receipt. Incorporate minor comments to the procedures, equipment, or personnel prior to testing. Major comments by the Construction Manager will require a resubmission of the field test procedure and proposed test date. The Design-Builder will be notified, in writing, by the Construction Manager if a formal resubmission is required with the transmittal of the review comments.

H. **Additional Notice Requirements:** Provide 7 (seven) days written notice to the Construction Manager prior to the actual start of any testing. This will include a statement by the Design-Builder that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

I. **Test Report Requirements:** At conclusion of the test the Design-Builder will deliver draft test report data, and then submit, within 7 (seven) days after completion of the tests, 6 (six) copies of the following to the Construction Manager for approval:

1. Completed test forms, for each device tested, on forms provided by the Design-Builder prior to the tests.
2. Completed certification documentation, the content of which was approved prior to the tests.
3. A written summary of the test; a report of the results and a summary of the entire procedure.
4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

6-8.2.3.9 System Loop Checks.

A. Loop checks are performed jointly by the Design-Builder and the Control Systems Provider after field testing. The Design-Builder will have primary responsibility and will provide personnel to insure that the installed equipment and/or instruments are properly installed and operating during loop checks. The Control Systems Provider will provide personnel to operate the Distributed Control System. The Design-Builder will provide communication equipment as required for the Control Systems Provider and Construction Manager personnel to insure coordinated communication between the field and the Control Room.

B. The Design-Builder will provide 30 (thirty) days written notice indicating the date and time when loop checks will start. Submit with this notice a loop check package which includes the following to the Construction Manager for approval:

1. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.
2. Schedule for Testing: Schedule shall include frequency of measurement, personnel present, and contingency plans for equipment and/or system failure.
3. Test forms: Provide test forms for recording and reporting on the test data.
4. Provide material and equipment required for the test.
5. Utility requirements: Utilities will be supplied by the Design-Builder for loop checks, as required.
6. Operational requirements: Include precautions which will be taking to protect equipment and personnel during testing.

C. The Construction Manager and the Owner may witness the performance of these tests, at their option.

D. Approval of the loop check package will be made within two weeks of the test date. Incorporate minor comments on the procedures and equipment prior to testing. Major comments by the Construction Manager will require a resubmission of the loop check package and test date.

E. The Design-Builder shall provide seven days written notice to the Construction Manager prior to the actual start of any testing.

F. The Design-Builder shall submit within one week after completion of the tests, the following to the Construction Manager for approval:

1. Completed test forms, for each loop tested on forms provided by the Design-Builder and approved prior to the test.
2. Written summary of testing, reporting on the results and summarizing the entire procedure.
3. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of these requirements, due to negligence, poor workmanship, or products that fail to meet the Contract requirements, shall be at no additional cost to the Owner.

6-8.2.3.10 Functional Testing.

A. When listed in 6-8.2.3.14, specific functional tests shall be performed by the Contractor who supplied the equipment being tested in addition to the requirement for shop, field, and other tests called for in the Technical Specifications. If more than one Contractor supplied the equipment being tested, each Contractor will provide a representative for the functional test team, and the team leader will be the representative from the Contractor with the major piece of equipment being tested. If no clear distinction exists under these criteria, then the Contractor with the largest dollar value of equipment incorporated into the system being tested shall be the team leader. Functional tests will be performed with fluid or gaseous substances that are generally non-septic, non-corrosive, non-toxic, and non-inflammable.

B. The Design-Builder shall provide 45 days written notice in accordance with 6-8.2.3.5, indicating the date and time during which the specified functional test is proposed. Submit with this notice a contract specific functional test plan which follows the generic functional test plan included in the contract, and which includes the following to the Construction Manager for approval:

1. Description of the system's equipment, piping, valves, instruments and other components, and the applicable specification sections.
2. Test procedures to be provided by Engineer.
3. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.
4. **Personnel Used to Perform the Tests:** The Design-Builder shall submit resumes and qualifications of persons to be assigned to perform the tests. As a minimum, personnel must have one year experience with the operation of the equipment and/or system to be tested and have participated in at least one similar test during this period of experience.
5. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or system test failure.
6. Test forms: Provide test forms for recording and reporting on the test data.
7. Material and equipment required for the test.
8. Utility requirements: Utility requirements will be identified and supplied by the Design-Builder for functional testing purposes. Provide labor for the reuse of the test water.
9. Operational requirements: Include valve positions, set-ups, and gate positions that are required to run the tests in the written request so that the Construction Manager can anticipate and plan for the testing. Provide all temporary piping, connections or other temporary requirements related to performance of the functional tests.

10. The Design-Builder shall develop a Function Test Schedule which allows no less than 120 days to complete the Functional Test Program.

C. The Design-Builder shall be obligated for installation and cost associated with all temporary materials and systems required to facilitate functional testing.

D. The Construction Manager, and the Owner will direct specific actions when conflicts surface and will witness the performance of these tests.

E. Approval of the functional test package by the Construction Manager will be made within two weeks of the test date. Incorporate minor comments on the procedures, equipment, and personnel prior to testing. Major comments by the Construction Manager will require a resubmission of the functional test package and test date.

F. Provide seven days written notice to the Construction Manager prior to the actual start of any testing. This will include a statement by the Design-Builder that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

G. Submit within 7 (seven) days after completion of the tests, 6 (six) copies of the following to the Construction Manager for approval:

1. Completed test forms, for each device, or system tested, on forms approved prior to the test.

2. Completed certification, the content of which was approved prior to the tests.

3. A written summary of the test; a report of the results and a summary of the entire procedure.

4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements due to negligence, poor workmanship, or products that fail to meet the Contract requirements, shall be at no additional cost to the Owner.

6-8.2.3.11 Corrections to the Work.

Correct any items of work failing to meet the specified requirements, at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or replacement, at the option of the Construction Manager. This includes the provision of all required labor, materials, and requirements for retesting as specified herein, to verify that the items conform with Contract Documents.

6-8.2.3.12 Safety. Conduct all specified test procedures in compliance with all applicable safety standards and regulations.

6-8.2.3.13 Support for Functional Testing.

If the operation of the Design-Builder's equipment is necessary to support the testing of other Design-Builder's equipment, the Owner may direct the Design-Builder, in writing, to provide operations support. A change order will be prepared for the cost of the following items:

A. Prepare and submit an Operations Plan to the Construction Manager to provide for the operation and maintenance of their equipment to support the testing of other Design-Builder's equipment. The plan will define all operations and maintenance requirements for a period up to and including six months. The Construction Manager will review and approve the Operations Plan. Details of the Operations Plan shall include the following:

1. Standard Operating Procedures for starting, stopping, and routine operation.

2. Procedures and schedules for the lubrication, calibration, and other items required for proper maintenance of equipment.

3. Utilities to be supplied by the Design-Builder for operations support purposes.

B. In the event an Operations Support Plan is approved and accepted by the Construction Manager, and the Design-Builder is directed in writing by the Owner to proceed with implementation, the Construction Manager will prepare an operations punch list which defines the items and services which are not completed and their value. Retainage will then be reduced to the value of this incomplete WORK.

The one (1) year warranty period will not begin until final start-up and operation.

6-8.2.3.14 Equipment Requiring Functional Testing.

Functional testing shall be conducted on the following systems:

1. Dewatering Centrifuges

6-8.2.4 Project Closeout.

The Design-Builder shall promptly remove from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the Owner will be withheld until the Design-Builder has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

6-8.2.4.1 Closeout Timetable.

The Design-Builder shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the Owner, the Construction Manager, and their authorized representatives sufficient time to schedule attendance at such activities.

6-8.2.4.2 Owner's Manual Submittal.

The Design-Builder's attention is directed to the condition that neither final payment nor release of retention shall become due, per Section 9 of the Whitebook, if at the 75 percent construction completion point, the approved Owner's Manual complying with Section 2-5.3.7 has not been submitted. The aforementioned amount will be retained by the Owner as the agreed, estimated value of the approved Owner's Manuals. Any such retention of money for failure to submit the approved Owner's Manuals on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the Design-Builder as specified in Article 14 of the General Conditions.

6-8.2.4.3 Final Submittals.

The Design-Builder, prior to requesting final payment, shall obtain and submit the following items to the Construction Manager for transmittal to the Owner:

1. Written guarantees, where required.
2. Operating manuals and instructions.
3. New permanent cylinders and key blanks for all locks.
4. Maintenance stock items; spare parts; special tools.
5. Completed record drawings.
6. Bonds for roofing, maintenance, etc., as required.

7. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
8. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

6-8.2.4.4 Maintenance and Guarantee.

A. The Design-Builder shall comply with the maintenance and guarantee requirements contained in Article 13 of the General Conditions.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the Design-Builder which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the Design-Builder shall have obtained a statement in writing from the affected private owner or public agency releasing the Owner from further responsibility in connection with such repair or resurfacing.

C. The Design-Builder shall make all repairs and replacements promptly upon receipt of written order from the Owner. If the Design-Builder fails to make such repairs or replacements promptly, the Owner reserves the right to do the WORK and the Design-Builder and his surety shall be liable to the Owner for the cost thereof.

6-8.2.4.5 Bond.

The Design-Builder shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and Article 13 of the General Conditions.

6-8.3 Warranty. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.3 Warranty. Unless specified otherwise, the Work shall be warranted by the Contractor against defective workmanship and materials for a period of 1 year.

a) The warranty period shall start on the date of completion of the Work as determined by the Engineer.

b) The Contractor shall involve the manufacturer in the installation and startup as needed to secure any extended warranty required.

c) The warranty period for specific items covered under manufacturers' or suppliers' warranties shall commence on the date they are placed into service at the direction of or as approved by the Engineer in writing.

d) All warranties, express or implied, from Subcontractors or Suppliers, of any tier, for the work performed and materials furnished shall be assigned, in writing, to the City, and such warranties shall be delivered to the Engineer prior to acceptance of the Contractor's performance of the Contract.

e) Centrifuge warranty shall cover defects in materials and workmanship for 8,760 running hours or twenty-four (24) months from beneficial use or for a period not to exceed thirty (30) months from shipment, whichever occurs first. The centrifuge supplier will be allowed to review operating and maintenance records to ensure compliance.

f) The Contractor shall replace or repair defective Work in a manner satisfactory to the Engineer, after notice to do so from the Engineer, and within the time specified in the notice. If the Contractor fails to make such replacement or repairs within the time specified in the notice, the City may perform the replacement or repairs at the Contractor's expense. If the Contractor fails to reimburse the City for the actual costs, the Contractor's Surety shall be liable for the cost thereof.

g) Nothing in this warranty is intended to limit any manufacturer's warranty which provides the City with greater warranty rights than set forth in this section or the Contract Documents.

h) These specifications are not intended to constitute a period of limitations or waiver of any other rights or remedies City may have regarding the Contractor's other obligations under the Contract Documents or federal or state law.

i) The Contractor shall respond and initiate corrective action within 24 hours of notice of nonconforming Work that poses an imminent threat to person or property.

ADD: 6-8.4 Latent and Patent Defect Warranty. For Design-Build contracts, the Contractor shall warrant to City that the construction, including all materials and equipment furnished as part of the construction, shall be free of latent and patent defects in materials and workmanship. The City will first provide the Contractor an opportunity to correct or replace any latent and patent defect at its own cost and expense, if notified by the City within 4 years after the date of Acceptance for patent deficiency and 10 years for a latent deficiency. If the Contractor fails to repair and replace the reported deficiency, the City will repair the deficiency and charge the Contractor for the repair.

6-9 LIQUIDATED DAMAGES. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

MODIFY to increase the daily value from $250 to $500.

All WORK under this Contract shall be completed within 1092 Calendar Days from the date of issuance of the Notice to Proceed. It is the intent of this contract to make beneficial use of the centrifuges as soon as they are delivered to site, installed and accepted. The DESIGN-BUILDER will be assessed liquidated damages if a centrifuge is not available for beneficial use to the CITY within 120 calendar days of delivery to the site. Where more than one centrifuge is delivered at the same time, liquidated damages will be assessed based on each centrifuge being installed and accepted over a 120 calendar day period per centrifuge. Two centrifuges shall be procured by the DESIGN-BUILDER per fiscal year and shall be fully operational following installation and acceptance testing per the schedule below.

City's Fiscal Year	Number of Centrifuges	Operational No Later Than
2013	2	302 Calendar Days following NTP
2014	2	667 Calendar Days following NTP
2015	2	1092 Calendar Days following NTP

Failure to complete the WORK within the Contract Time and the above schedule will result in damages being assessed by the City.

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 this contract.

ADD: 7-3.1 Policies and Procedures.

a) You must procure the insurance described below, at your 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.

b) Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.

c) 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 this contract, e.g., your indemnity obligations, will is not deemed limited to the insurance coverage required by this contract.

d) 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.

e) 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 this contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of this contract may be treated by the City as a material breach of contract.

ADD: 7-3.2 Types of Insurance.

7-3.2.1 Commercial General Liability Insurance.

a) 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.

b) 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).

c) 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.

d) All costs of defense must be outside the policy limits. Policy coverage must be in liability limits of not less than the following:

General Annual Aggregate Limit	Limits of Liability
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.

a) 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").

b) All costs of defense must be outside the limits of the policy.

ADD: 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 Eligible Surplus Lines Insurers (LESLI 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.

ADD: 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.

ADD: 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.

   The additional insured coverage for projects for which the Engineer's Estimate (i.e., City's estimated construction cost for this contract) 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.

   1. The additional insured coverage for projects for which the Engineer's Estimate (i.e., City's estimated construction cost for this contract) 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 the Contractor's 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.

ADD: 7-3.6 Deductibles and Self-Insured Retentions. You are responsible for the payment of all deductibles and self-insured retentions. Disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.

ADD: 7-3.7 Reservation of Rights. We reserve 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. We 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.

ADD: 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.

ADD: 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.

a) In accordance with the provisions of §3700 of the California Labor Code, you must provide at its 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.

b) Limits for this insurance must be not less than the following:

Workers' Compensation	Statutory Employers Liability
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

c) By signing and returning this 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 will 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:

a) The Project is subject to the Storm Water Pollution control requirements listed on the Plans or as specified in these specifications.

b) For contracts subject to Construction General Permit (CGP), the Contractor's QSD shall verify the City's assessment prior to submittal through SMARTS.

c) The Contractor's attention is directed to Section 801, "WATER POLLUTION CONTROL" of these specifications for more information.

7-9 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS. ADD the following:

In any emergency affecting the safety of persons or property, the Contractor shall act, at its discretion, to prevent threatened damage, injury or loss. Any change in Contract Price or Contract Time resulting from emergency work shall be determined as provided in SECTION 3, "CHANGES IN WORK."

7-10.1 Traffic and Access. To the City Supplement, DELETE the agency notification listing in its entirety and SUBSTITUTE with the following:

The Contractor shall notify Metropolitan Transit System (MTS), a minimum of 5 Working Days prior to excavation, construction, or traffic control affecting bus stops. The Contractor shall notify the remaining agencies a minimum of two 2 Working Days prior to construction activities affecting the agencies:

Fire Department Dispatch	(Street or alley closure)	(858) 573-1300
Police Department Traffic	(Street or alley closure)	(858) 495-7800
Street Division/Electrical	(Traffic signals)	(619) 527-7500
U.S. Navy	(32nd Street Naval Station)	(619) 556-1319
Underground Service Alert	(Any excavation)	(800) 422-4133
MTS	(Street Closure and Bus Stops)	(619) 238-0100 Ext 6451

7-13.2 Access for Disabled Persons. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

For Design-Build contracts, the Design-Builder shall warrant and certify that all Project Plans and Specifications prepared in accordance with this contract shall meet all current requirements of the California Building Code, California Code of Regulations, Title 24 (Title 24) and the Americans with Disabilities Act (ADA) and the ADA Standards for Accessible Design. When a conflict exists between the ADA Standards for Accessible Design, Title 24 and the WHITEBOOK - City Supplement, the most restrictive requirement shall be followed. As a condition precedent to Award of this contract, the Design-Builder shall submit to City the Design-Builder Certification for Title 24/ADA Compliance.

The Design-Builder shall comply with all portions of the ADA and Title 24. (For specific services and public accommodations, The Design-Builder may contact the Office of the Americans with Disabilities Act, Civil Rights Division, U.S. Department of Justice, P.O. Box 66118, Washington, D.C. 20035-6118; phone number (202) 514-0301.) The Design-Builder acknowledges and agrees that the Design-Builder is aware of and will comply with Council Policy 100-04, incorporated herein by this reference, adopted by Resolution No. R-282153, relating to the federally-mandated ADA. The Design-Builder and contractors will be individually responsible for administering their own ADA and Title 24 program.

Code Implementation:

a) The 2010 Americans with Disabilities Act (ADA) regulations will take effect on April 15, 2011.

b) The 2010 ADA Standards for Accessible Design will take effect on April 15, 2012. Designers may choose either the 1991 ADAAG or the 2010 ADA Standards if the project is to be designed before the adoption date but all new construction and alteration projects must comply with the 2010 ADA Standards if construction is to start on or after April 15, 2012.

c) The 2010 California Building Code, California Code of Regulations, Title 24 will take effect on January 1, 2011.

The Design-Builder shall pay all claims, costs, losses and damages incurred by the City in undertaking remedial action to correct City determined violations of ADA or Title 24. To effectuate remedial action, the City will issue a Change Order incorporating the necessary revisions in the

Construction Documents. The City will be entitled to an appropriate decrease in the Contract Price, and, if the Parties are unable to agree as to the amount thereof, The City may unilaterally issue the Change Order.

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

ADD: 7-15 INDEMNIFICATION AND HOLD HARMLESS AGREEMENT. The Contractor shall defend, indemnify, protect, and hold harmless the City, its agents, officers, and employees, from and against all claims asserted, or liability established for damages or injuries to any person or property resulting from the Contractor's action or failure to take the necessary measures to prevent such damages and injuries.

The Contractor shall be responsible for payment of any fines resulting from citations issued to the City by either the federal, state, or local environmental and safety enforcement agencies due to the Contractor's failure to abide by applicable safety, health, and environmental standards.

7-18.b DESIGN-BUILDER'S RESPONSIBILITIES. To the City Supplement, ADD the following:

The Design-Builder must sequence the removal and replacement of the centrifuges. Due to plant operating constraints only one centrifuge may be taken out of operation at any one time. The DESIGN-BUILDER must completely replace a centrifuge and completely start up, commission and turn over to the OWNER per the contract documents before the next centrifuge replacement can be started. The DESIGN-BUILDER must also conform to the phase funding requirements of this contract. The order of replacement of centrifuges must be coordinated with operations during the preconstruction meeting defined in these documents.

ADD: 7-21 ELECTRONIC COMMUNICATION. The Contractor shall post all communications addressed to the Engineer concerning construction including RFIs, submittals, daily logs, and transmittals to the Virtual Project Manager (VPM) website established for the Project. The Contractor shall maintain a list of scheduled activities including planned and actual execution dates for all major construction activities and milestones defined in the approved Schedule. The Contractor shall review and act on all communications addressed to the Contractor in the VPM project website. A user's guide to the VPM system is available on the City's website and will be provided to the Contractor at the preconstruction meeting. The payment for electronic communications shall be included in the various Bid items.

SECTION 9 – MEASUREMENT AND PAYMENT

9-3.3.1 Payment for Stored Materials. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

ADD: 9-3.3.1 Payment for Stored Materials.

9-3.3.1.1 General. When included in the SSP, the Contractor may request payment for materials and equipment which will be incorporated into the Work and are delivered to the Project or stored in or near the Site.

a) The material shall meet the Contract requirements. The required test results and certifications shall be on file with the Engineer.

b) Consideration will only be given to non-perishable materials for major items of the Work or Materials Subject to Price Adjustment provided each such individual item has a value of more than 1% of the Contract Price and will become a permanent part of the work.

c) Materials cost shall be evidenced by manufacturer's paid invoice bearing the statement that all previous invoices have been paid.

d) The payments for materials on hand shall not exceed the invoice price or 60% of the bid prices for the pay items into which the materials are to be incorporated, whichever is less, unless otherwise approved by the Engineer.

e) The Contractor shall make application for payment for materials on hand or stored on a form provided by the City and attach documentation to show:

1. the amount originally paid on the invoice (or other record of production cost) for the items on hand,
2. the dollar amount of the material incorporated into each of the various work items for the month,
3. the amount that should be retained in material on hand items,
4. the Contractor has received the materials and equipment free and clear of all liens, charges, secured interests, and encumbrances, and
5. the materials and equipment are covered by appropriate property insurance in accordance with the insurance provisions and other arrangements to protect the City's interest.

f) The Contractor shall provide the City, upon request and prior to any partial payment, documentation which transfers absolute legal title to such materials to the City conditional only upon receipt of Final Payment. Neither such transfer of title nor any partial payment shall constitute acceptance by the City of the materials, nor void the right to reject materials subsequently found to be unsatisfactory in accordance with 4-1, "MATERIALS AND WORKMANSHIP" or in any way relieve the Contractor of any obligation arising under the Contract Documents.

g) The payments for materials on hand shall be subject to retention as set forth in 9-3.2, "Partial and Final Payment."

h) The Contractor shall assume all risks associated with the loss or damage to the stored products for which payment has been received or not.

i) Equipment and material shall be stored in accordance with manufacturer's recommendations. The stored products shall be in a form ready for installation. The City will not pay for raw materials or parts and pieces of equipment.

j) Any and all surplus materials that are not incorporated in Work will become the property of the Contractor at no additional cost to the City.

k) **Unless specifically provided in the contract**, payment for materials on hand is not included when determining the percentage of Work completed.

9-3.3.1.2 Payment for Stored Materials off Site. Payment for materials and equipments delivered and stored off-site shall be contingent upon the Contractor's compliance with the storage and protective maintenance requirements set forth in the Contract Documents and all other requirements necessary to preserve equipment warranties for the benefit of the City.

a) The City reserves the right to refuse approval for payment for any equipment or materials suitably stored off-site in its sole discretion, regardless of whether all conditions herein have been met.

b) Costs associated with delivery to and storage at an off-site facility shall be assumed by the Contractor regardless of the City's approval to deliver and store the materials.

c) The Contractor shall provide written evidence to the City of having made arrangements for unrestricted access by the City and its authorized representatives to the materials wherever stored, including provision for the City to take control and possession of such materials at any time and without restriction. The Contractor shall furnish the City a permit of entry, from the

owner of the property, for at least 6 months after the NOC has been filed. The permit of entry shall contain information similar to the following:

"PERMIT OF ENTRY: Permission is hereby granted to the City and its designated employees or agents to enter upon the property described herein for a period of not less than 6 months after the NOC has been filed for (Project Name) for the purpose of removing materials for which advance materials on hand payment has been made to (Contractor's Name). The property is owned by (Owner's Name) and is described as follows: (Address and Description of Property). (Include signature(s) and date(s) for owner and lessee or purchaser, and, if appropriate, attach a copy of a warehouse receipt or contract for storage.)"

d) The material shall be clearly marked and identified as being specifically fabricated, produced, and reserved for use on the Project.

PART 2 - CONSTRUCTION MATERIALS

SECTION 207 – PIPE

207-15.7 Installation Time Limit. DELETE in its entirety and SUBSTITUTE with the following:

PVC Pipe, fittings and couplings shall comply to the requirements of 207-28, "Pipe Acceptance."

207-17.1 General. ADD the following:

All House Connection Sewer Laterals shall use acceptable stainless steel shielded couplings manufactured by Mission, Fernco or approved equal.

ADD: 207-17.2.3 Pipe Manufacturer. Pipe, fittings, couplings, and joints as manufactured or distributed by J-M Manufacturing Company shall not be used on this contract.

207-17.4.2 Acceptance. DELETE in its entirety.

207-26 PIPE Appurtenances. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Valves shall have internal and external fusion bonded epoxy coating in accordance with AWWA C-116 and C-213.

Painting of exposed surface of valve well caps shall be in accordance with the "Gate Well Identification" Standard Drawing, for valves 4" (100mm) and larger.

Valve key extensions shall be installed for butterfly valves and gate valves when top of gate valve nut is 6' or more below ground or pavement surface. Types of joints for fittings are called out on Plans. Valves used with PVC pipe shall have mechanical joint ends.

207-26.1.5 Polyvinyl Chloride Pipe 2" Only. To the City Supplement, DELETE in its entirety.

207-26.3 Gate Valves. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Gate valves shall be resilient seated conforming to the provisions of AWWA C-509, unless metal seated are specified. Gate valves shall conform to AWWA C-500, as modified herein, except that valves 3" (75 mm) and under shall be all bronze; conforming to ASTM B62. Valves less than 16" shall be gate type, with a ductile iron body, unless otherwise specified.

Valves shall have bottom or side wedging double discs, parallel seats, all bronze internal working parts, either "O" rings or stuffing box stem seals, and two inch square operating nut. Valves shall open by turning the stem counter-clockwise. Ends shall be as specified, designed for use with the connecting pipe. Components made from brass or bronze shall be of a grade containing not more

than 16% zinc and not more than 2 percent aluminum in accordance with 5.5 of the AWWA C-500 for waters with specific conductance exceeding 350 micro Mho per am.

Valves 16" (400 mm) and larger, if specified, shall be designed for horizontal mounting, with 4" by-passes and totally enclosed gear case. Integral or extended gear cases are acceptable.

External bolts and nuts for valve fittings shall be hexagonal head machine bolts and hexagonal nuts conforming to ASTM 307, Grade B or SAE Grade 2. Bolt threads shall be lubricated with graphite and oil prior to installation.

207-26.4 Butterfly Valves. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Only resilient-seated butterfly valves are allowed. Valves 16" and larger shall be butterfly with a ductile iron body, unless otherwise specified. Butterfly valves and operators shall conform to AWWA C-504, "Standard for Rubber-Seated Butterfly Valves", as modified and supplemented herein.

Valves and operators shall be Class 150B, totally enclosed for direct burial in the ground without a vault. Valves and operators shall be designed for installation in a nearly horizontal pipeline with the disc shaft horizontal and the operating shaft vertical. Valves shall be either short body, or long body, with ends as specified. Flanged ends shall conform to AWWA C-207.

Butterfly valves greater than 16" shall have a by-pass installed by the contractor around them. The bypass shall be 4" for valves up 36", and 6" for valves greater than 36". The bypass shall include a gate valve, and it shall be the same size as the bypass.

The operator shall be manual traveling nut type with a 2" (50 mm) square operating nut conforming to AWWA C504, and shall open the valve when turned counter-clockwise. The operator shall have a mechanical stop, which will withstand an input torque of 450 ft lbs. (610 Newton-meter), against the stop. The traveling nut shall engage alignment grooves in the housing. The operator shall have a built in packing leak bypass to eliminate possible leakage into the operator housing.

The number of turns required to fully close the valve from a fully open position is shown in the table below for valve diameter 6" (150 mm) to 48" (1200 mm).

Valve Diameter inch (mm)	Minimum Number of Turns to Close
6 (150)	30 turns
8 (200)	30 turns
10 (250)	30 turns
12 (300)	30 turns
14 (350)	30 turns
16 (400)	30 turns
18 (450)	40 turns
20 (500)	40 turns
24 (600)	40 turns
30 (750)	44 turns
36 (900)	136 turns
42 (1050)	136 turns
48 (1200)	136 turns

The operator, and any other parts requiring lubrication, shall be fully lubricated at the factory and shall require no additional lubrication for the life of the valve. Seats shall be Peroxide Cure EPDM

The valve disc shall be of stainless steel or ductile iron. The metal seating surfaces which meet the rubber seat shall be of stainless steel.

Bolts and nuts for valve end flanges shall be hexagonal head bolts and hexagonal nuts conforming to ASTM 307, Grade B or SAE Grade 2. Bolt threads shall be lubricated with graphite or oil prior to installation.

Prior to the installation of working parts, all internal steel or cast iron surfaces of valves, except finish or bearing surfaces, shall be coated with approved epoxy in accordance with AWWA C-550, "Protective Interim Coatings for Valve and Hydrants." The interior epoxy surface shall be tested with an approved holiday detector.

207-26.4.1 Class 250B Butterfly Valves. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

This subsection applies to 16" (400 mm) through 54" (1350 mm) Class 250B butterfly valves.

Butterfly valves shall conform to the requirements of AWWA C-504 for Class 250B service in terms of performance criteria. Class 250B Butterfly valves shall have flanged ends, be manually operated, tight closing, and have rubber seats made from Peroxide Cure EPDM. Valves shall be bubble-tight at the rated pressure with flow in either direction, and shall be satisfactory for applications involving throttling service and/or frequent operation after long periods of inactivity. Valves and valve operators shall be suitable for buried service. Valves and valve operators shall comply with these specifications, other accepted standards for butterfly valves, and the following enhancements and exceptions:

a) Valve Bodies shall be short and constructed of ductile iron conforming to ASTM A536 Grade 65-45-12, unless cast iron conforming to ASTM A 126 Class B is specified. Flanges shall be flat-faced and flange drilling shall be in accordance with ANSI B16.1, Class 125 or Class 250, as specified on the plans. On valves 30" (750 mm) and larger the valve port diameter shall not reduce more than a 1.5" (37.5 mm) of nominal diameter. Flow direction shall be indicated on the valve body. The use of stops or lugs cast integrally with or mechanically secured to the body for limiting disc travel shall not be acceptable.

b) Valve Disc shall have no external ribs transverse to the flow of water through the valve. The disc shall not have any hollow chambers that can entrap water. The disc shall be made from cast iron ASTM A126 Class B or ductile iron ASTM A536. The disc shall be furnished with a nickel-chrome or stainless steel type 316 seating edge to mate with the rubber seat.

c) The Valve Seat shall be attached to the valve body. Retaining rings, clamps, screws and bolts attaching the rubber seat to the valve body shall be fabricated from stainless steel type 316. For valves 24" (600 mm) and larger, valve seats shall be field adjustable around the 360 degree circumference and replaceable without dismantling the operator, disc or shaft and without removing the valve from the pipeline. The valve manufacturer shall certify the rubber seat is field replaceable as specified above. Spool-type rubber liners covering the entire surface of the valve body and extending over any portion of the flange faces will not be acceptable. Valves employing the use of snap rings to retain the rubber seat will not be acceptable.

d) Rubber for valve seats shall conform to the applicable provisions of AWWA C-504 and be Peroxide Cure EPDM.

e) Valve shafts shall be stainless steel ASTM A564 Type 630 Condition H-1100.

f) The valve/disc connection shall be made through the use of on-center taper pins. The taper pins shall be of the same material as the valve shaft.

g) Shaft Seals shall be self-adjusting standard split V packing and be provided where the shaft Projects through the valve body. Packing shall be retained by the actuator or actuator mounting plate. Adjustable packing bonnets are not allowed. Shaft seals shall be of design allowing replacement without removing the valve shaft.

h) Valve Bearings shall be sleeve type that is corrosion resistant and self-lubricating. Thrust bearings shall be provided in accordance with the governing standard. Thrust bearings, which are exposed to water and consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface, shall not be acceptable.

i) Valve Operator shall be fully grease packed and have stops in the open and closed position. The operator shall have a mechanical stop, which will withstand an input torque of 450 ft lbs. (610 Newton-meter), against the stop. The traveling nut shall engage alignment grooves in the housing. The operator shall have a built in packing leak bypass to eliminate possible leakage into the operator housing. The operator shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. The operator shall be sized to provide adequate torque to operate the valve on which it is mounted at the full pressure rating of the valve. Operators shall meet minimum requirements for AWWA C-504.

j) Butterfly valves greater than 16" and larger shall have a by-pass installed by the contractor around them. The bypass shall be 4" for valves up 36", and 6" for valves greater than 36". The bypass shall include a gate valve, and it shall be the same size as the bypass.

k) Valve Operator shall be mounted on the valve at the valve manufacturer's facility. The valve manufacturer shall insure proper operator sizing and satisfactorily test the operator and valve assembly prior to shipment to the Site.

l) Valves shall be hydrostatic and leak tested. The leak test shall be performed in both directions at a differential pressure of 250 psi (1.7 Megapascal) with the disc in a closed position. In a slightly open position, internal hydrostatic pressure equal to 500 psi (3.45 Megapascal) shall be applied to the inside of the valve body for 5 minutes. Proof of a design cycle test in accordance with AWWA C-504 Section 5.2.4.3 shall be submitted before installation.

207-26.5. Plug Valve. To the City Supplement, DELETE in its entirety.

ADD: 207-28 PVC PIPE ACCEPTANCE. When the pipe is delivered to the Work site, the Engineer may require additional testing to determine conformance with the requirements of pipe flattening, impact pressure, pipe stiffness, and extrusion quality.

1. For All PVC Pipe (i.e., pressurized and gravity):

   a) The Contractor shall provide information to the Engineer for verifying the quantity of pipe, the manufacturing and delivery date, and that the pipe stored is the same material documented on the Certificate of Compliance.

   b) The Contractor shall provide explanation of pipe marking to include manufacturing date and location.

   c) If the pipe will not be installed within 6 months of manufacture date, the Contractor shall protect the pipe from environmental degradation (e.g., UV rays and sunlight) in accordance with the manufacturer's recommendations.

   d) The Contractor shall insure that the PVC pipe is stored locally (i.e., within 25 mile radius) and that the Engineer has reasonable access to the pipe at the storage location.

   e) The stored pipe shall not be removed from the storage for purposes other than the Project without the Engineer's approval.

   f) PVC pipe handled and stored in accordance with these specifications will be acceptable for installation for up to 2 years from the date of manufacture without repeat testing.

   g) The Engineer may process payment for store PVC pipe in accordance with 9-3.3.1, "Payment for Stored Materials" and 9-3.3.2, "Payment for Stored Materials off Site."

2. For PVC Pipe Older Than 6 Months:

   For PVC pipe older than 6 months from date of manufacture as evidenced by pipe markings and the Certificate of Compliance that has not been stored and handled as outlined above:

   a) Prior to installation of PVC pipe, the Contractor shall submit to the Engineer a current (i.e., no older than 60 days) complete set of third party independent test results for each separate lot of pipe consisting of:

      *Flattening capability conforming to ASTM D2412

      *Extrusion quality by the acetone-immersion method as specified in ASTM D2152

   b) Test results shall identify the pipe by its markings as provided by the manufacturer.

   c) PVC pipe installation may not proceed prior to submittal of test results by the Contractor and written acceptance by the Engineer.

   d) PVC pipe tested as outlined above shall be accepted for installation for a maximum of 6 months from the date of testing unless it is stored and handled in accordance with these specifications immediately after testing.

   e) PVC pipe that is not stored locally (i.e., within 25 mile radius of the Site), or where the Engineer does not have reasonable access to verify storage and handling, shall be retested in accordance with these specifications within 60 days prior to installation per 207-15.7, "Installation Time Limit."

   f) After initial testing, PVC pipe handled and stored in accordance with these specifications may be accepted for installation for up to 2 years from date of manufacture without repeat testing.

   g) The Engineer may process payment for store PVC pipe in accordance with 9-3.3.1, "Payment for Stored Materials" and 9-3.3.2, "Payment for Stored Materials off Site."

SECTION 216 – DETECTABLE WARNING TILES

216-1.2 Materials. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Materials for DWT specified herein shall be per the City's Approved Materials List (AML). The tiles shall have the manufacturer's logo stamped permanently on the product with identifying information such as model number and type.

a) The Stainless Steel Cast in Place DWT shall be of 16 gauge Type 304L with an integral micro-texture non-slip surface stamped into the stainless steel plate on the top of the domes and in the field surface between the domes. It shall have an ultra violet stabilized coating.

b) Vitrified Polymer Composite (VPC) Cast in Place DWT shall be an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. VPC Product shall be provided with a 5-year manufacturer written warranty form materials and installation.

c) For others materials and a complete listing of material physical property requirements refer to the City's AML.

SECTION 803 – ENCOUNTERING OR RELEASING HAZARDOUS SUBSTANCES

To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

SECTION 803 – ENCOUNTERING OR RELEASING HAZARDOUS SUBSTANCES

803-1 GENERAL.

1. If the Contractor encounters, causes the release of, or has knowledge of a release or an imminent release of Hazardous Substances or petroleum products, construction activities in the area shall immediately cease except in an emergency.

2. A waste determination shall be performed on all potential Hazardous Waste or Regulated Waste generated at a Site within 10 days of generation to determine if it meets Hazardous Waste or Regulated Waste criteria in accordance with 22 CCR Division 4.5, 23 CCR Division 3, or any other pertinent law or regulation which could restrict the disposal of the waste to a municipal landfill, sewer discharge, or storm drain discharge. The results of all waste determinations shall be submitted to the City for concurrence prior to any disposal or discharge of the waste in question.

3. Incomplete or inconclusive waste determinations conducted by the Contractor, as determined by the City, will be returned to the Contractor for additional information or testing. The City's approval of the final determination of the waste and the disposal or discharge location shall be required.

4. Substances requiring analytical testing shall be sampled and tested in accordance with the sampling and analytical testing requirements in these specifications.

5. If a community health and safety plan is required for a specific site or Project, the Contractor shall fully comply with all of the requirements.

6. The Contractor shall follow and comply with all applicable Federal, State, and local laws and regulations and notification requirements.

7. The Contractor shall not resume work in any such affected area until after the Contractor has determined that such condition and any affected area has been rendered safe for the resumption of Work, or specifying any special conditions under which Work may be resumed safely.

8. The business entities proposed for use by the Contractor related to hazardous substance or petroleum product management shall be in good regulatory standing and have not received regulatory fines more than $25,000 in total in the past 3 years. These entities include:

   a) The licensed Hazardous Waste Transporter.

   b) The Petroleum Contaminated Soil Disposal and Recycling facility.

   c) The TSDF.

   d) Handling Facility.

9. If the Contractor encounters unforeseen Hazardous Substances or petroleum products, the Contractor shall immediately notify the Engineer and County of San Diego, Department of Environmental Health (DEH) at (858) 505-6880. If there is an immediate fire, explosion, or health or safety threat, the Contractor shall notify the Fire Department via 911.

10. If flammable liquids or other hazardous substances or regulated wastes are encountered during the construction activities, construction staff shall be required to have a HAZWOPER certificate in compliance with CCR Title 8, Section 5192 and 29 CFR, Part 1910.

803-2 Community Health and Safety Plan.

803-2.1 General.

1. The Contractor shall prepare a community health and safety plan (Plan) to address the potential of encountering at the Work Site:
2. Hazardous Substances and Regulated Waste contaminates (e.g., lead or solvents) in soil and in the groundwater as identified in Special Provisions, historic environmental documents, or on the Geotracker website (http://geotracker.waterboards.ca.gov/).
3. Gasoline and other fuel constituents contaminates with the contingency of encountering flammable or combustible liquids in the groundwater during dewatering activities in the areas specified in the Special Provisions, historic environmental documents, or on the Geotracker website at the Site.

803-2.2 Certified Industrial Hygienist (CIH). A Certified Industrial Hygienist shall certify, oversee the Plan, and shall monitor Site activities to confirm no health and safety hazardous condition exists during the Work. The CIH shall outline, in the Plan, the actions to be taken by the Contractor and the CIH on how health and safety concerns or measured contaminants will be addressed when they are encountered.

803-2.3 Monitoring Devices. The Contractor shall have the CIH or other Contractor staff trained by the CIH or has received formal training to utilize the following monitoring devices at the Work Site and adhere to the action levels for each contaminate identified in the Plan:

1. Photo Ionization Detector (PID)
2. Combustible gas indicator (CGI)
3. Benzene Monitor (required when gasoline or other petroleum fuels may be encountered in a specific area)
4. X-Ray Fluorescence (XRF) analyzer (required when lead bearing contaminated soil may be encountered in a specific area)

803-2.4 Plan Elements.

803-2.4.1 Site Identification and Location. Provide a detailed plot plan that identifies all on-site and surrounding structures, topography, prevailing wind directions, all surrounding land uses, nearby populations and environments, and any known receptors of special concern.

803-2.4.2 Evaluation of Potential Public Exposure to Hazards. Provide a description of the potential public health hazards and exposure pathways resulting from Work Site activities, including vapors, dust, fires, explosions, and physical hazards. Consider both immediate and long-term hazards.

803-2.4.3 Monitoring Equipment. Provide a description of the site monitoring equipment specified above and any additional equipment identified in the Plan to monitor contaminates, the action levels for each contaminate identified in the Plan, and the protocol to be used to protect the public.

803-2.4.4 Control Methods. Provide a discussion of the administrative and engineering controls that will be implemented to prevent or minimize public exposure to chemical and physical hazards. Include control methods necessary to prohibit public access, prevent fugitive dust, mist, odors, and vapors. As a part of the administrative controls, the CIH shall conduct training with all Contractor staff on the requirements of the Plan.

803-2.4.5 **Site Security.** Describe the method(s) that will be used to exclude the public from, or limit public access to, the work area and the site in general.

803-2.4.6 **Vapors, Mists, and Odors.** Describe the method(s) that will be used to minimize public exposure to potential vapor and mist emissions and odors resulting from the proposed activities. Engineering and construction practices can typically reduce such emissions. Acceptable control methods include, but are not limited to pumping out non-aqueous phase liquids (NAPL), covering off-gassing excavations or stockpiles, backfilling off-gassing excavations, using off-gassing stockpiles as backfill, misting excavations or stockpiles with water, covering excavations or stockpiles with foam or other vapor suppressing agents, locating stockpiles away from and downwind of public receptors, and stopping work.

803-2.4.7 **Dust.** Describe the method(s) that will be used to minimize potential public exposure to dust generated as a result of the proposed activities. Acceptable control methods include, but are not limited to covering sources, misting sources with water, reducing the pace of site activities, and stopping work.

803-2.4.8 **Open Excavations.** Discuss the management of any excavations that may result from the proposed activities. Open excavations present a clear risk to the community and adequate site security is critical to protect the public.

803-2.4.9 **Stockpiled or Containerized Soil.** Discuss the soil management procedures and the proposed disposition of the stockpiled and containerized soil including the time frame in which activities will occur. Stockpiled soil shall be contained within berms and covered to prevent runoff, and vapor and dust exposures as specified in section 803-17. Stockpiled and containerized soil shall be stored in a secured area of the worksite to prevent public access.

803-2.4.10 **Other Hazardous Wastes.** Discuss the secured storage area for any other hazardous waste generated at the Site.

803-2.4.11 **Contact Information.**

1. Site Safety Manager - Provide the name and telephone number of a site safety manager who will be available 24 hours a day and who shall have the knowledge and authority necessary to shut down all on-site activities in the event of an emergency.
2. Certified Industrial Hygienist - Provide the name and qualifications of the CIH which demonstrate adequate experience in monitoring and taking action to protect the community for each type of contaminate identified in the Plan.
3. Construction Staff - Provide the names of workers assigned to assist in the implementation of the Plan and the scope of their roles. If a worker is identified to assist in using a monitoring device or other task to implement the Plan, provide information (e.g., resume, experience, and training certificate) which demonstrates the employee has the knowledge, skills, and ability to adequately complete the task.

803-2.4.12 **Emergency Planning.**

1. Provide a description of the methods and equipment that will be used to address possible community emergency situations. The surface collection of a flammable or combustible substance and the build-up of explosive concentrations of vapors are examples of community emergency situations that must be addressed if methane, gasoline, or other combustible or flammable chemical constituent are encountered.

2. In the event of a sudden release of a Hazardous Substance or Regulated Waste to the environment, identify the roles of the site safety manager, CIH, and worker(s) for the Site management and cleanup activities. Include in the procedures how the chemical release or imminent chemical release will be evaluated for regulatory reporting and who will be responsible to report the incident to all appropriate regulatory agencies according to all applicable laws as well as to the Engineer.

803-2.4.13 Public Notification.

1. Provide a description of the Public Notification Program (Program). The Program shall include the preparation and distribution of notices to residences and businesses adjacent to, or in the vicinity of, potential impacts from the site or area where Work is being performed. Notices shall also be posted around the perimeter of the Site.

2. At a minimum, the notification shall contain the following information:

   a) List the name and 24-hour telephone number of the site safety manager and the person(s) to contact regarding problems (e.g., odors, dust, and noise).

   b) Provide a brief description of the proposed activities.

   c) Provide the dates and times that the Work will be conducted and when the Work will be completed.

   d) Include any requisite Proposition 65 warnings. Proposition 65 (Health and Safety Code, §25249.6,) requires that a warning be given to any individual who is exposed to a chemical known to cause cancer. Check the current Proposition 65 list for chemicals requiring such warnings.

803-3 CITY'S RESPONSIBILITY. The City will be responsible for any Hazardous Substances and Hazardous Waste as defined by §§ 25316 and 25117 of the California Health and Safety Code, uncovered or revealed at the Site which existed prior to the date of the NTP and was not identified in the Contract Documents to be within the scope of the Work. The City shall not be responsible for any such materials brought to the Site after the NTP.

803-4 DEFINITIONS. For the purpose of these specifications the following definitions apply:

Burn Ash - The residual ash that results from the low temperature combustion of solid waste. Burn ash is generally found at a location where solid waste has been burned and the resulting debris have been buried or stockpiled.

Chemical Release - any Spilling, leaking, pumping, pouring, emitting, emptying, discharging, dumping, injecting, escaping, leaching, or disposing into the environment as defined by HSC 25501 (s), 19 CCR, 40 CFR 302, and any other applicable regulatory definition.

Closed Container - a container is closed when the lid, ring, gaskets, and bung are latched, screwed, and tightened in such as way that the contents, including vapors, are confined within the space of the container.

Empty Hazardous Materials Containers - a container which previously held a Hazardous Material is considered empty when: i) the container, when it is held in any orientation (e.g., inverted, tilted, etc.) and no liquid drains from the container, ii) all of the solids have been removed by a physical method so that no more than a thin uniform film remains in the container. Empty Hazardous Material containers are Hazardous Waste unless managed in accordance with 22 CCR 66261.7.

Handling Facility - A facility that is not licensed as a TSDF and has been permitted in California to legally accept a Hazardous Material or recyclable waste for reuse, recycling, or other legal handling method. This excludes facilities accepting petroleum contaminated soils. See Petroleum Contaminated Soil Disposal and Recycling Facility definition below.

Hazardous Material - a material which may cause harm to humans, animals, or the environment as defined by HSC 25501 (o) and implemented in HSC Chapter 6.5 and 22 CCR.

Hazardous Substance - a Hazardous Material, hazardous waste, petroleum products, or any chemical product which a manufacturer or producer is required to prepare an MSDS or as defined by HSC 25501(p) and 25281 (h).

Hazardous Waste - A Hazardous Material that can no longer be used for its intended purpose as defined in HSC 25115, HSC 25117, and HSC 25316 and implemented in HSC Chapter 6.5 and 22 CCR and 40 CFR Part 260 - 299

Hazardous Waste Determination - The process which shall be used to determine if a waste is hazardous or non-hazardous as required in 22 CCR and testing methods in SW-846.

Hazardous Waste Manifest - the state and federal approved shipping document required by law to track the transportation and disposal of hazardous waste. The document is originated and signed by the generator of the waste in accordance with 22 CCR.

Licensed Hazardous Waste Transporter - A transportation company which holds all of the following valid permits, identification numbers, licenses, and registrations:

1. California Department of Toxic Substances Control permit
2. California Department of Motor Vehicles – Motor Carrier Permit
3. U. S. Environmental Protection Agency – Identification number
4. U. S. Department of Transportation – Identification number
5. U. S. Department of Transportation – Hazardous Materials Certificate of Registration
6. California Highway Patrol – License

MSDS - Material Safety Data Sheet

Non-RCRA Hazardous Waste - A waste that is defined and regulated as Hazardous Waste only within the State of California and defined in California regulation 22 CCR Division 4.5, Chapter 11, Article 3.

RCRA Hazardous Waste - A waste which is managed as Hazardous Waste within and outside the State of California and is defined in Federal regulation 40 CFR Part 261 and California regulation 22 CCR Division 4.5, Chapter 11, Article 4.

Regulated Waste - A waste, that is not considered Hazardous Waste, but due to its chemical or physical properties, petroleum contamination, or other properties, it must be disposed of to a facility with Regional Water Quality Control Board approved Waste Discharge Requirements (WDRs), such as a municipal Class III landfill or other facility with WDRs that allow disposal of the Regulated Waste.

Spill - Refer to the definition of Chemical Release and Threatened Release

Treated Wood - Wood that has been treated with a chemical preservative for purposes of protecting the wood against attacks from insects, microorganisms, fungi, and other environmental conditions that can lead to decay of the wood and the chemical preservative is registered pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. § 136 and following).

Threatened Release – a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment.

TEEM - Tank Engineering and Environmental Management

Universal Waste - An item, substance, or object which must be stored, handled, and disposed of as defined by CCR Title 22, Chapter 23, §§ 66273.1-66273.90.

803-5 **TREATMENT, STORAGE AND DISPOSAL FACILITIES (TSDF).** TSDF shall be a hazardous waste transfer, treatment, storage, or disposal facility that has received, at a minimum, a California Department of Toxic Substances Control permit, grant of interim status, or a variance or is otherwise authorized by California law and regulations to receive specific RCRA and/or non-RCRA Hazardous Wastes for Processing, Recycling, alternative fuel, or Disposal. If the TSDF is located outside the jurisdiction of California, the agency(ies) with regulatory authority over the TSDF shall have the same or higher standards for the processing, recycling, or disposal of hazardous waste as the State of California.

803-6 **PETROLEUM CONTAMINATED SOILS DISPOSAL AND RECYCLING FACILITY.** Petroleum Contaminated Soils Disposal and Recycling Facility shall be a recycling or disposal facility which has, at a minimum, a valid California Regional Water Quality Control Board permit including Waste Discharge Requirements (DWRs) and air emission permit to receive specific Petroleum Contaminated Soil for processing, bioremediation, recycling, alternative fuel, or disposal. If a facility chosen is located outside the jurisdiction of California or within Indian Tribal lands, the agency(ies) with regulatory authority over the Petroleum Contaminated Soil Disposal and Recycling Facility shall have the same or higher standards for the recycling or disposal of petroleum contaminated soil as the State of California.

803-7 **HAZARDOUS SUBSTANCES MANAGEMENT PLAN.**

1. For general management of Hazardous Materials, hazardous wastes, petroleum contaminated soil, and Regulated Wastes at the Site, the Contractor shall submit a Hazardous Substances Management Plan in accordance with 2-5.3, "Submittals" subject to the following regulations prior to start of the Work:
   a) 49 Code of Federal Regulations (49 CFR)
   b) 40 Code of Federal Regulations (40 CFR)
   c) California Code of Regulations, Title 22 (22 CCR)
   d) California Code of Regulations, Title 19 (19 CCR)
   e) California Health and Safety Code, Chapter 6.5 (HSC)
   f) Uniform Fire Code (UFC)
2. The Contractor's submittal shall include:
   a) A description on how the Contractor will store, manage, and inspect all Hazardous Materials brought to the Site including the management of all containers, drums, and tanks.

b) A listing of all hazardous wastes, petroleum contaminated soils, and Regulated Wastes anticipated to be generated, or encountered, during the course of the Project and the name of the trained Hazardous Waste contractor(s) who will perform the testing, removal, storage, transportation, and disposal activities for each waste type listed.

3. When disposing of the Non-RCRA Hazardous Waste, petroleum contaminated soil, and Regulated Waste outside the State of California or to Indian Country or Indian tribal lands, the Contractor shall utilize facilities as defined in these specifications.

4. The following information for each RCRA Hazardous Waste, Non-RCRA Hazardous Waste, petroleum contamination soil, and Regulated Waste that is expected to be encountered during the construction:

a) Name of the RCRA Hazardous Waste, Non-RCRA Hazardous Waste, petroleum contaminated soil, or Regulated Waste.

b) Disposal Method i.e., recycling, alternative fuel, bioremediation, thermal desorption incineration, treatment, Class I, II or III Landfill.

c) Name of Licensed Hazardous Waste Transporter(s).

d) Name of Treatment, Storage, and Disposal Facility (TSDF), Petroleum Contaminated Soil Disposal/Recycling Facility, or Handling Facility where the waste will be treated, recycled and/or disposed. Include the name(s) of any interim facilities where the hazardous waste, petroleum contaminated soil, and/or Regulated Waste will be stored, handled, or treated prior to shipping to the final destination facility.

e) Waste Matrix Example: Hazardous Waste, Petroleum Contaminated Soil, and Regulated Waste Disposal Information Submittal.

Waste Stream	Disposal Method	Transporter 1	Transporter 2	Facility	Facility
HazWaste #1	Treatment	ABC Haz Waste Transporter	None	Acme Neutralization	None
Regulated Waste #1	Recycle	XYZ Transporter	HazMat Hauler	Smith Recyclers	None
HazWaste #2	Incinerate	ABC Haz Waste Transporter	HazWaste Transporter	ABC Transfer Station	Acme Incineration
Petroleum Contaminated Soil	Thermal Desorption	XYZ Transporter	None	XYZ soil recyclers	

f) For each Hazardous Waste transporter and facility listed, include the name, address, phone number, company contact and list all registrations, permits, licenses, and identification numbers as specified in these specifications.

g) Laboratory testing, if required, provide the following:

1) Name, address, phone number, company contact, and certification number for each certified Hazardous Waste testing laboratory used.

2) A list of the tests each laboratory is certified to perform under the laboratory's State certification.

5. After start of the Work, the following submittals shall be made by the Contractor:

   a) Hazardous Waste Storage Logs submitted weekly.

   b) Periodically During Work: Chemical Release Spill Report Forms, as necessary.

   c) Hazardous Waste Disposal and Laboratory Testing, as needed.

   d) Draft Hazardous Waste Manifests for approval submitted prior to scheduling disposal.

   e) Two legible copies of each Hazardous Waste Manifest used submitted immediately after receipt from transporter.

   f) Copies of all other disposal receipts and documentation i.e., Bills of Lading submitted immediately after receipt from transporter.

   g) Copies of analytical test data submitted within 1 day of receipt from laboratory.

   h) Approved waste profiles submitted prior to scheduling disposal.

803-8 **EMPLOYEE TRAINING.** The Contractor's employees and Subcontractors who manage Hazardous Waste shall be trained to ensure compliance with all regulations and shall maintain certification throughout the duration of the project. Copies of certificates shall be submitted to the Engineer prior to the start of Construction. The Contractor's employees and Subcontractors working at the Site shall be able to respond effectively to emergency situations including Chemical Releases (22 CCR 66265.16).

803-9 **SAMPLING AND ANALYTICAL TESTING REQUIREMENTS.**

1. A suspect item or waste that may be hazardous or contain a hazardous or regulated component or petroleum contamination shall be separated from other waste for the City's determination if a Waste Characterization is needed or if the suspect item or waste, or petroleum contamination had been identified in the contract.

2. Each testing method shall be approved by the City as appropriate for the sample being tested prior to having a certified laboratory conduct the test.

3. Representative samples shall be obtained by the Contractor for each waste to be tested with the sampling procedure and sample naming sequence pre-approved by the City. The City shall be contacted prior to sampling and may be present to observe the sampling. Items sampled without the presence or approval of the City may require the item or waste to be re-sampled.

4. Containers e.g., jars, bags, etc. used for sampling shall be certified by a State licensed Hazardous Waste Laboratory as "pre-cleaned." Samples shall be sent to a State licensed Hazardous Waste Laboratory for testing. The Laboratory shall have a valid State license for each requested test to be conducted on the sample. The sample testing time and preliminary results shall be available on the 5th Working Day or other agreed upon date after the sample was taken.

5. A final copy of all analytical test results and the sampling chain-of-custody form shall be provided to the City within 1 Working Day of receipt from the State Hazardous Waste certified testing laboratory.

803-10 HAZARDOUS MATERIALS AND WASTES STORAGE AND MANAGEMENT.

1. Hazardous Substances, Hazardous Wastes, or items, and equipment containing Hazardous Substances or Hazardous Wastes shall be handled in such a way as to minimize the possibility of a release.
2. Hazardous Substances shall always be kept in an approved, compatible, and Closed Container with a legible label identifying the contents. No interim containers including such as bags, transfer containers, buckets, or pails shall be acceptable.
3. Containers used to package Hazardous Waste shall be compatible with the waste (22 CCR 66265.172), maintained in good condition (22 CCR 66265.171), and kept closed unless adding or removing waste (22 CCR 66265.173).
4. Different waste types shall be stored in separate containers and incompatible wastes shall never be combined or stored near each other.
5. Any packaging used to store and or transport Hazardous Waste off-site such as a container, roll-off bin, tank or other device, shall comply with 49 CFR Parts 173, 178, 179 and be labeled and prepared for transportation in accordance with 22 CCR Article 3.
6. A Hazardous Waste label shall be affixed to the container and filled out when the first amount of Hazardous Waste or Hazardous Substance is placed in the container. The label shall include the generator information, contents of the container, physical state and hazardous properties of the waste, and the initial accumulation date. The Contract appendices contain a sample Hazardous Waste label.
7. The Contractor shall use a numbering system to identify each Hazardous Waste container. Each Hazardous Waste container shall be marked with an identification number specific to that individual container.
8. Additional pre-transportation labeling and marking or using placards shall be conducted prior to transporting Hazardous Waste off-site and in accordance with 22 CCR Chapter 12, Article 3 and 49 CFR.
9. Containers, containment systems, and tanks of Hazardous Materials and Hazardous Waste shall be managed in a way which minimizes the threat of fire, explosion, or any unplanned sudden or non-sudden release of Hazardous Waste to the air, soil, or surface water which could threaten human health or the environment (22 CCR 66265.31).
10. Secondary containment shall be provided at a minimum for storage areas containing 55 gallons or more of Hazardous Material or hazardous waste. The secondary containment area shall be capable of holding the contents of the largest container plus 10% of that volume or in accordance with applicable regulations (22 CCR 66264.175).
11. Secondary containment areas shall be maintained so any releases will be confined within the secondary containment area. Rips, tears, cracks, breaks, etc. that compromise the integrity of the secondary containment shall be immediately repaired.
12. Secondary containment systems shall be maintained free of dirt, debris or liquids of any kind. If any chemical is released into the secondary containment system, it shall be removed immediately.

13. Material used in or around the secondary containment area which has been contaminated with a Hazardous Material or Hazardous Waste shall not be disposed until a Hazardous Waste Hazardous Waste Determination has been performed in accordance with these specifications. Contaminated materials include, but are not limited to, plastic sheeting, absorbents, dirt, sand, and kitty litter. Contaminated materials found in or around containment areas shall be immediately cleaned-up.

14. When conducting a waste determination on soil, procedures and protocol specified in the Site Assessment and Mitigation Manual (SAM Manual) shall be followed.

15. The Contractor shall perform weekly inspections of their Hazardous Material and Hazardous Waste storage areas to comply with the regulations (22 CCR 66265.174). An inventory of Hazardous Waste containers will be kept noting each waste container and its accumulation start date. Inspections shall be documented and copies provided to the City upon request.

803-11 TREATED WOOD WASTE (TWW) MANAGEMENT AND DISPOSAL.

1. TWW is regulated under California Code Regulations Title 22, division 4.5, chapter 34 and Department of Toxic Substances Control (DTSC).

2. TWW contains hazardous chemicals and shall be managed as hazardous waste or as specified in CCR Title 22, Chapter 34 "Alternative Management Standards for Treated Wood Waste". A summary of the regulations can be found on DTSC's website: http://www.dtsc.ca.gov/hazardouswaste/treated_wood_waste.cfm).

3. The generation of TWW during construction projects shall be handled, labeled, stored, tested, and disposed of as described in CCR Title 22, Chapter 34 "Alternative Management Standards for Treated Wood Waste". A summary of the regulations can be found in DTSC's "Requirements for Generators of Treated Wood Waste Fact Sheet" under the section noted "Businesses generating TWW during the normal course of business."

4. TWW shall be disposed of at an authorized composite lined solid waste facility or through a licensed hazardous waste facility.

5. An employer resizing, sorting, or segregating TWW shall provide training for all employees handling TWW and all employees that may reasonably be expected to contact TWW (22 CCR 67386.10). A record of the training shall be maintained for a period of 3 years and available for review. The training shall include:

   a) all applicable requirements of the California Occupational Safety and Health Act of 1973 (ch. 1, part 1, div. 5 (commencing with § 6300) of the Labor Code), including all rules, regulations, and orders relating to hazardous waste;

   b) procedures for identifying and segregating TWW;

   c) safe handling practices;

   d) requirements of the alternative management standards; and

   e) proper disposal methods.

803-12 HAZARDOUS WASTE, REGULATED WASTE, PETROLEUM CONTAMINATED SOIL ACCUMULATION TIME.

1. Each container or pile of Hazardous Waste shall be shipped off-site for disposal by a licensed Hazardous Waste transporter within 90 days of the date of initial generation or by the end of the Project, whichever comes first. Regulated Wastes

and petroleum contaminated soils shall be shipped off-site for proper recycling or disposal within 90 days of the initial generation or by the end of the project, whichever comes first.

803-13 HAZARDOUS WASTE TRANSPORTATION REQUIREMENTS.

1. The City will provide the Contractor with the EPA Generator Identification number for the Site. This number is site specific and shall only be used on Hazardous Waste disposal documentation for the appropriate site where the waste was generated.
2. A Hazardous Waste Manifest or, when appropriate, a bill of lading, non-Hazardous Waste Manifest or other appropriate disposal documentation shall be completed in accordance with 22 CCR Chapter 12, Article 2 and 49 CFR for any shipment of Hazardous Waste leaving the Site.
3. The Engineer or other designated City representative will sign the Hazardous Waste Manifest or disposal documentation as representing the Hazardous Waste generator at the time the Hazardous Waste is being removed from the Site. Pre-signed Hazardous Waste Manifests or bills of lading are not acceptable.
4. The Contractor shall only ship Hazardous Waste using a City pre-approved Hazardous Waste Licensed Hazardous Waste Transporter with valid insurance certificates in accordance with 7-3, "Liability Insurance." The Hazardous Waste shall be sent only to a treatment, storage, and disposal facility (TSDF) that is approved by the City in the Hazardous Substances Management Plan submittal in accordance with 22 CCR Chapter 13. Any contractor who allows the transportation or disposal of Hazardous Waste from a City site by an unlicensed Hazardous Waste Transporter, upon conviction, shall be subject to 1 year in prison and fined up to $100,000 per day (HSC 25163, 25189.5).

803-14 MANAGEMENT OF SPECIFIED WASTES.

1. The Hazardous Material that is removed from Empty Hazardous Materials Containers shall be used as Hazardous Material or disposed of as a Hazardous Waste. The Contractor shall mark each container with the date it was emptied and manage the container within one year by one of the following methods:
   a) Reclaim the scrap value of the container;
   b) Send the container off-site for reconditioning or remanufacturing;
   c) Send the container back to the manufacturer; or
   d) Dispose of as hazardous waste.
2. For containers 5 gallons capacity or less, once the container is empty, it may be disposed of to the regular trash.
3. Aerosol spray containers may be disposed of in the regular trash if the contents and propellant have been emptied to the maximum extent practical under normal use (i.e., the spray mechanism was not defective and thus allowed complete discharge of the contents and propellant). Aerosol spray containers shall not be punctured, crushed or altered in order to remove or release any remaining contents or propellant for the purpose of emptying the container for disposal to the trash.
4. A compressed gas cylinder is empty when the pressure in the container approaches atmospheric pressure.

803-15 REGULATORY REPORTING FOR CHEMICAL RELEASE OR THREATENED RELEASE.

1. Chemical Releases or Threatened Releases involving a gas, liquid or solid Hazardous Materials or Hazardous Waste shall be immediately assessed utilizing the County Department of Environmental Health's Assessment form as a guide to determine if the incident requires regulatory reporting to the Cal EMA; County Department of Environmental Health, Hazardous Materials Division; the National Response Center and any other pertinent regulatory agency. See the Contract appendices for a copy of County Department of Environmental Health's Assessment form.
2. Lack of immediate reporting a Chemical Release or Threatened Release shall be subject to fines and penalties by the County of San Diego and any other pertinent regulatory agency.
3. Chemical Releases or Threatened Releases involving a gas, liquid or solid Hazardous Materials or Hazardous Waste shall be immediately reported to the City after completing all regulatory reporting.
4. Chemical Releases and any contaminated media (rags, absorbents, soil, etc.) shall be immediately contained, cleaned up, and handled as Hazardous Waste at the Contractor's expense. The waste shall be handled as Hazardous Waste unless a complete Hazardous Waste Determination, as approved by the City, is performed indicating the waste to be non-hazardous.
5. A Chemical Release Report Form or similar document shall be completed and faxed to the City at the designated number within 4 hours of the occurrence of the chemical release for all incidents of Hazardous Materials or Hazardous Wastes in quantities equal to or exceeding 5 gallons in quantity or for any size release that required regulatory reporting as determined by the County Department of Environmental Health's Assessment form. The Contract appendices contain a blank Chemical Release Report Form.

803-16 ENCOUNTERING CONTAMINATED SOIL.

1. Contaminated soils have specific soil contaminants which cause the soil to be defined as a RCRA Hazardous Waste, Non-RCRA Hazardous Waste, petroleum contaminated soil, or Regulated Waste.
2. When encountering petroleum contaminated soil, abandoned underground storage tanks, petroleum transmission pipelines, Burn Ash, or unidentified contamination, the Contractor shall follow the guidelines of the current edition of the County of San Diego, Department of Environmental health (DEH) Site Assessment and Mitigation Manual (SAM Manual), which is available by contacting the DEH at (858) 505-6880.
3. If the Contractor encounters unforeseen contaminated soil, the Contractor shall immediately notify the Engineer when apparent contaminated soils are encountered. Following notice by the Contractor, the Engineer will contact the City's Environmental Services Department, Office of Environmental Protection and Sustainability, TEEM Program at (858) 627-3311.

803-17 MONITORING OF POTENTIALLY PETROLEUM CONTAMINATED SOIL.

1. Monitoring for the presence of petroleum contamination shall be the Contractor's responsibility and shall be performed in areas of known or suspected contamination during construction activities. The Contractor shall notify the Engineer 5 days prior to excavation in areas of known contamination, and immediately if suspected or unforeseen contamination is encountered.

2. An operational Explosimeter (Combustible Gas Indicator - CGI), calibrated for and capable of automatically detecting explosive gases at 20% of the Lower Explosive Limit (LEL) shall be used by the Contractor. The functional requirements of the CGI shall comply with the Site Assessment and Mitigation (SAM) Manual. If 20% or greater of the Lower Explosive Limit (LEL) is detected in an excavation, surface area or confined space, the Fire Department and the DEH shall be notified immediately. In areas of known or suspected contamination, an operational Photo Ionization Device (PID) shall also be used at all times by Contractor staff formally trained to operate a PID. Any soil that triggers PID detection shall be segregated and stockpiled for further characterization.

3. The Contractor will not be reimbursed for costs associated with monitoring activities as the City considers these efforts to be integral and essential to best management health and safety practices for trenching and excavation operations.

803-18 Stockpiling Contaminated Soil.

1. Unless directed otherwise by the Engineer, the Contractor shall stockpile all suspect contaminated soil (as indicated by appearance, odor, or PID detection) at a location approved by the Engineer and the TEEM Program and in accordance to the following procedure. Stockpiled contaminated soil and/or Hazardous Waste shall be:

   a) Placed on a relatively impervious surface such as asphalt, concrete or on minimum 8-mil thick polyethylene sheeting.

   b) Moistened to minimize dust emissions during stockpiling. However, no run-off shall be permitted at any time.

   c) Securely covered by 8-mil polyethylene sheeting to minimize vapor emissions and prevent run-off from rain (sheeting shall be maintained and remain in satisfactory condition).

   d) Configured in such a manner that surface water run-off from the stockpile does not carry soil, leachate, or both beyond the stockpile perimeter berm.

   e) Separated from uncontaminated soil.

2. The Contractor shall manage the contaminated soil properly. The City shall not be liable for contaminated soil improperly handled or disposed by the Contractor.

803-19 DISPOSAL OF CONTAMINATED SOIL.

1. Contaminated soil that is a RCRA Hazardous Waste or Non-RCRA Hazardous Waste shall be transported to a licensed TSDF and as approved in the Hazardous Substances Management Plan submittal.

2. Contaminated soil that is a Regulated Waste, shall be transported to a licensed treatment facility which meets the California Regional Water Quality Control Board's WDRs for that waste type and is approved in the Hazardous Substances Management Plan submittal in accordance with, 803-7, "HAZARDOUS SUBSTANCES MANAGEMENT PLAN." If the treatment facility will not accept the contaminated soil, the Regulated Waste will then be sent to a State licensed Class III landfill or other facility with WDRs that accept the Regulated Waste.

3. The Contractor shall obtain pre-approval for the Contractor's proposed treatment or disposal facility in accordance with 803-7, "HAZARDOUS SUBSTANCES MANAGEMENT PLAN." The Contractor shall obtain all necessary approvals and authorizations from the treatment or disposal facility and shall provide them to the Engineer and City's TEEM Program a minimum of 5 Working Days prior to scheduling transport.

4. The Contractor shall use a Regulated Waste or Non-Hazardous Waste data form to document the disposal from the Work Site of the contaminated soil that is identified as Regulated Waste. The Contractor shall use a Hazardous Waste Manifest for all soils identified as RCRA or Non-RCRA Hazardous Waste.

5. The Contractor shall provide the Engineer and City's TEEM Program with manifests for each load at least 48 hours prior to the scheduled pickup date. The City's TEEM Program will review the manifests for accuracy. All manifests shall be signed off by the Engineer or TEEM Program on the date of loading and transport. Copies of executed manifests and treatment or disposal certificates shall be provided to the Engineer and City's TEEM Program as specified in 803-7, "HAZARDOUS SUBSTANCES MANAGEMENT PLAN."

6. The Contractor shall manage the contaminated soil properly. The City shall not be liable for contaminated soil improperly handled or disposed by the Contractor.

803-20 PAYMENT.

1. Payment for waste management shall be included in the applicable Bid items as follows:

   a) Preparation of Hazardous Waste Management Plan and Reporting (LS).

   b) Monitoring, Testing, Sampling, Site Storage, and Handling of Soils Containing RCRA Hazardous Waste (TON).

   c) Loading, Transportation, and Disposal of soils containing RCRA Hazardous Waste (TON).

   d) Monitoring, Testing, Sampling, Site Storage and Handling of Petroleum Contaminated Soil (TON).

   e) Loading, Transportation, and Disposal of Petroleum Contaminated Soil (TON).

   f) Monitoring, Testing, Sampling Site Storage and Handling of Soils Containing Non-RCRA Hazardous Waste (TON).

   g) Loading, Transportation, and Disposal of Soils Containing Non-RCRA Hazardous Waste (TON).

   h) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Containerized RCRA Hazardous Waste (55 Gal DRUMS).

   i) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Containerized Non-RCRA Hazardous Waste (55 Gal DRUMS).

   j) Testing, Sampling, Site Storage, Handling, Transportation and Recycling/Disposal of Universal Waste (EACH).

   k) Testing, Sampling, Site Storage, Handling, Transportation and Recycling/Disposal of Regulated Waste (TON).

   l) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of RCRA Hazardous Waste contamination from the treatment of contaminated ground water (GAL).

m) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Non-RCRA Hazardous Waste contamination from the treatment of contaminated ground water (GAL).

2. Shorter testing time and availability of preliminary results may be required by the Engineer and paid as Extra Work.

3. Payment for the management and disposal of TWW will be made as Extra Work unless a separate lump sum Bid item has been provided.

SECTION 804 – SEWAGE SPILL PREVENTION

To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

804-1 GENERAL. The Contractor shall observe and comply with the City's policy of zero spills. **The Contractor shall be liable for all damages and fines associated with sewage spills caused by improper support or damage to the existing sewer facilities.**

The Contractor shall designate a person responsible for the development and enforcement of the Sewage Spill Response Plan, and for ensuring sewer spills are minimized to the maximum extent possible. The Contractor shall provide a status of all bypass related work at biweekly progress meetings as requested by the City.

804-2 SEWAGE SPILL PREVENTION AND RESPONSE PLAN. Prior to the start of construction, the Contractor shall develop and submit to the Engineer, for review and approval, a written Sewage Spill Prevention and Response Plan. The plan shall include sewage spill response plan, spill containment and cleanup plan, staging area, and sewage bypass and pumping plan.

The Sewage Spill Prevention and Response Plan shall be developed to respond to any construction related sewage spill(s). The plan shall include:

a) Identifying all nearby environmentally-sensitive areas such as waterways, channels, catch basins and entrances to existing underground storm drains.

b) Making arrangements for an emergency response unit, stationed at or near the Site, comprised of emergency response equipment and trained personnel to be immediately dispatched in the event of a sewage spill(s). This includes field biologists, archaeologists, or both if in an environmentally-sensitive area such as a canyon.

c) Developing an emergency notification procedure that includes an emergency response team with telephone numbers and arrangements for backup personnel and equipment. The emergency response unit shall be able to dispatch to the Site 24 hours a day 7 days a week including weekends and holidays. The Contractor shall designate primary and secondary representatives, their respective phone numbers, pager numbers, and mobile phone numbers. These Contractor's representatives shall be accessible and available at all times to respond immediately to any sewer spill event.

d) Identifying any property owners who may be affected e.g., the City Park and Recreation Department.

At the pre-construction meeting the Contractor will be provided with a list of the City representatives to contact in case of sewage spill(s). In case of a sewage spill(s), the Contractor shall immediately call the Sewage Spill Hotline number at (619) 527-5481 and shall act immediately without instructions from the City, to control the spill and take all appropriate steps to contain it in accordance with the Sewage Spill Prevention and Response Plan and 804-2.1, "Sewage Bypass and Pumping Plan." The Contractor shall immediately notify the City representatives of the spill and shall report Project name, location, Contractor name, Project Engineer, and Engineer names.

The Contractor shall, within 3 Working Days from the occurrence of the spill, submit to the Engineer a written report describing the following information related to the spill: the location; the nature and estimated volume; the date and time; the duration; the cause; the type of remedial and/or clean up measures taken (including erosion control measures) and the date and time of implementation; the corrective and/or preventive actions taken to avoid further spills; equipment used in spill response; and the environmentally-sensitive habitat such as a water body, if any, impacted and results of any necessary monitoring. The Contractor shall provide a list of who from the City was notified, date and time of notification, date and time the Contractor was notified of the spill, date and time the Contractor arrived on Site.

The Engineer may institute further corrective actions, as deemed necessary, to fully comply with existing laws, ordinances, codes, order or other pertinent regulations. In addition to any penalties provided by federal, state, and local laws, the Contractor shall be responsible for all costs incurred for the corrective actions including mitigation measures (habitat restoration, etc.) and obtaining after-the-fact permits if necessary, in environmentally sensitive areas. These permits include but are not limited to those from the City Planning Department Development Services, California Coastal Commission, U.S. Army Corps of Engineers and the California Department of Fish and Game.

It shall be the Contractor's responsibility to assure that all field forces, including Subcontractors, know and obey all safety and emergency procedures, including the Sewage Spill Prevention and Response Plan applicable to the work, to be maintained and followed at the Site. If in an environmentally sensitive area, such as canyon, stream, or lagoon, impacts shall be minimized. Crews shall be aware at the start of the job of any sensitive environmental habitats, breeding season restrictions, etc.

The Contractor shall prevent spills when working on sewer lines, such as when making temporary connection, when connecting new lines into the sewer system, ensuring no laterals are connected to mains being abandoned, ensuring diversions are appropriately installed, and diversions are completely removed when finished so there are no blockages. The Contractor shall not trap debris and discharge rock or debris downstream. Avoidance of streams is paramount unless authorized via permits.

The Contractor shall defend, indemnify, protect, and hold harmless the City, its agents, officers, and employees, from and against all claims asserted, or liability established for damages or injuries to any person or property resulting from any sewage spill caused or claimed to be caused by the Contractor's action or failure to take measures to prevent a spill. **The Contractor shall be responsible for payment of any fines assessed against the City for such sewage spills.** The Contractor's duty to indemnify and hold harmless shall not include any claims or liability arising from the established active or sole negligence or willful misconduct of the City, its agents, officers or employees.

The Contractor shall obtain and maintain an additional insurance coverage for Pollution Liability with its limits and requirements as set forth in 7-3.5.3, "Contractors Pollution Liability Insurance Endorsements." The limits and requirements for Pollution Liability shall be in an amount sufficient to cover potential losses from sudden and accidental pollution. Unless otherwise provided for in the Bid Proposal, all costs associated with the requirements for Sewage Spill Prevention and Response Plan, including additional insurance, shall be included in the prices for other related Bid items.

804-2.1 Sewage Bypass and Pumping Plan. The Contractor shall submit to the Engineer for approval, a Sewage Bypass and Pumping Plan at least 15 Working Days prior to implementation of flow diversion in compliance with the City's policy of "ZERO SPILLS." The Sewage Bypass and Pumping Plan shall indicate the sequence of diversion operations, all other operations the Contractor will establish to maintain wastewater service during the construction period, and a quality assurance and quality control plan for the diversion Work. The Sewage Bypass and Pumping Plan shall include an emergency response plan indicating the procedures, equipment, and activities that will be implemented in the event of an emergency shutdown or failure of the flow diversion equipment used for construction. The Contractor shall be responsible for implementation of the emergency plan in accordance with 804-2 "Sewage Spill Prevention and Response Plan".

The Contractor's Sewage Bypass and Pumping Plan shall be reviewed and approved by the Wastewater Collection Division of the City before flow can be diverted. No deviation from the approved Sewage Bypass and Pumping Plan will be allowed without prior approval from the Engineer.

The Contractor shall observe and comply with all Federal, State, and local laws, ordinances, codes, orders, and regulations which in any manner affect the conduct of the work, specifically as it relates to sewage spills. The Contractor shall be fully responsible for preventing sewage spill(s), containing any sewage spill(s), recovery and legal disposal of any spilled sewage, any fines, penalties, claims and liability arising from negligently causing a sewage spill(s), and any violation of any law, ordinance, code, order, or regulation as a result of the spill(s).

The Contractor shall exercise care not to damage existing public and private improvements, interrupt existing services or facility operations which may cause a sewage spill(s). Any reasonably anticipated utility or improvement which is damaged by the Contractor shall be immediately repaired at the expense of the Contractor. In the event that the Contractor damages an existing utility or interrupts an existing service, which causes a sewage spill(s), the Contractor shall immediately call the emergency number at (619) 515-3525.

The Contractor shall exercise care not to damage any sensitive habitats or historic resources unless authorized via the discretionary permit and Mitigation, Monitoring and Reporting Program approved by the City.

The Contractor shall provide all facilities, labor, power, and appurtenances necessary to divert wastewater flows as necessary to allow proper installation of the pipeline and/or manhole linings.

The Contractor shall submit as part of their Sewage Bypass and Pumping Plan their monitoring procedure and frequency and shall continuously monitor the flow levels downstream and upstream of the flow diversion to detect any possible failure that may cause a sewage backup and spill(s). The Contractor shall maintain a log of the monitoring and provide daily copies to the Engineer in a manner acceptable to the Engineer.

The Contractor shall inspect and maintain the diversion system daily, including the back-up system. The Contractor shall submit with their Sewage Bypass and Pumping Plan their maintenance procedures and frequency. The Contractor shall maintain a log of all inspection, maintenance and repair records, and provide copies to the Engineer upon request in a manner acceptable to the Engineer.

The Contractor shall size the flow diversion system to handle the peak flow and shall include a 100% backup in the flow diversion system. The Contractor shall provide temporary means to maintain and handle the sewage flow in the existing system as required to complete the necessary construction. The Contractor shall utilize the flow diversion system to mitigate any additional wet weather flows, perform the necessary maintenance and repairs on the flow diversion system, and exercise and ensure the operation of the backup system. Each pump, including the backup pumps, shall be a complete unit with its own suction and discharge piping. The Contractor shall operate the backup flow diversion system for a minimum of 25% of the total diversion time on a weekly basis. The backup flow diversion system shall be fully installed, operational, and ready for immediate use. The diversion system shall be hydraulically tested with clean water prior to wastewater flow diversion. The Contractor shall demonstrate to the satisfaction of the Engineer that both the primary and backup flow diversion systems are fully functional and adequate, and shall certify the same, in writing, to the Engineer in a manner acceptable to the Engineer.

The Contractor shall provide one dedicated fuel tank for every single pump or generator, if fuel or generator driven pumps are used. The Contractor shall provide an emergency standby power generator, if electric power driven pumps are used. The Contractor shall provide a fuel level indicator outside each fuel tank. The Contractor shall continuously (while in use) monitor the fuel level in the tanks and ensure that the fuel level does not drop below a level equivalent of two hours of continuous

flow diversion system operation. The Contractor shall take the necessary measures to ensure the fuel supply is protected against contamination. This includes but is not limited to fuel line water traps, fuel line filters, and protecting fuel stores from precipitation. The Contractor shall monitor all hoses and repair leaks immediately.

804-2.2 Payment Unless a Bid item has been provided, full compensation for the Sewage Bypass and Pumping Plan, its implementation e.g., labor, facilities, equipments, power, appurtenances and incidental, shall be included in the payment for sewer main.

SECTION 805 – WATER DISCHARGES

805-2.7 Payment. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Payment for dewatering will be made as follows:

a) The Allowance Bid item for Permit and Discharge Fees shall cover the payment for fees and the associated expenses e.g., water samples and lab testing for obtaining permits.

b) The payment for dewatering contaminated water containing hazardous substances and to bring the discharged water to the level that is in compliance with the permitting agencies' requirements and water quality standards will be included in the Allowance Bid item for "Dewatering Hazardous Contaminated Water."

c) The payment for dewatering contaminated water containing non-hazardous substances will be included in the Lump Sum Bid item for "Dewatering Non-Hazardous Contaminated Water."

d) For the payment for handling and disposal of the hazardous contamination, see 803-16 (l),(m), "Payment."

e) The payment for preparing health and safety plan shall be included in the various Bid items unless a Bid Item has been provided.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

APPENDIX A

Testing Standards For Electrical Components

For Electrical Testing Standards refer to the Technical Specifications in Attachment "A"

APPENDIX B

Materials Typically Accepted by Certificate of Compliance

Some of these items may be required. Design-Builder to confirm.

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 C

Sample City Invoice

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123					Contractor's Name:					
Project Name:					Contractor's Address:					
SAP No. (WBS/IO/CC)										
City Purchase Order No.					Contractor's Phone #:			Invoice No.		
Resident Engineer (RE):					Contractor's Fax #:			Invoice Date:		
RE Phone#:	RE Fax#:				Contact Name:			Billing Period:		
Item #	Item Description	Contract Authorization				Previous Estimate		This Estimate		Totals to Date	
		Unit	Qty	Price	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1	2 Parallel 4" PVC C900	LF	1,380	$34.00	$46,920.00						
2	48" Primary Steel Casing	LF	500	$1,000.00	$500,000.00						
3	2 Parallel 12" Secondary Steel	LF	1,120	$53.00	$59,360.00						
4	Construction and Rehab of PS 49	LS	1	$150,000.00	$150,000.00						
5	Demo	LS	1	$14,000.00	$14,000.00						
6	Install 6' High Chain Link Fence	LS	1	$5,600.00	$5,600.00						
7	General Site Restoration	LS	1	$3,700.00	$3,700.00						
8	10" Gravity Sewer	LF	10	$292.00	$2,920.00						
9	4" Blow Off Valves	EA	2	$9,800.00	$19,600.00						
10	Bonds	LS	1	$16,000.00	$16,000.00						
11	Field Orders	AL	1	80,000	$80,000.00						
11.1	**Field Order 1**	**LS**	**5,500**	**$1.00**	$5,500.00						
11.2	**Field Order 2**	**LS**	**7,500**	**$1.00**	$7,500.00						
11.3	**Field Order 3**	**LS**	**10,000**	**$1.00**	$10,000.00						
11.4	**Field Order 4**	**LS**	**6,500**	**$1.00**	$6,500.00						
12	**Certified Payroll**	**LS**	**1**	**$1,400.00**	$1,400.00						
	CHANGE ORDERS										
Change Order 1		**4,890**									
Items 1-4					**$11,250.00**						
Item 5-Deduct Bid Item 3		**LF**	**120**	**-$53.00**	($6,360.00)						
Change Order 2		**160,480**									
Items 1-3					**$95,000.00**						
Item 4 Deduct Bid Item 1		**LF**	**380**	**-$340.00**	($12,920.00)						
Item 5-Encrease bid Item 9		**LF**	**8**	**$9,800.00**	**$78,400.00**						
Change Order 3 (Close Out)		**-121,500**									
Item 1 Deduct Bid Item 3			**53**	**-500.00**	($26,500.00)						
Item 2 Deduct Bid Item 4		**LS**	**-1**	**45,000.00**	($45,000.00)						
Items 3-9			**1**	**-50,500.00**	($50,500.00)						
SUMMARY								Total This	$ -	**Total Billed**	$0.00
A. Original Contract Amount							**Retention and/or Escrow Payment Schedule**				
B. Approved Change Order 1 Thru 3							Total Retention Required as of this billing				
C. Total Authorized Amount (A+B)							Previous Retention Withheld in PO or in Escrow				
D. Total Billed to Date							Add'l Amt to Withhold in PO/Transfer in Escrow:				
E. Less Total Retention (5% of D)							Amt to Release to Contractor from PO/Escrow:				
F. Less Total Previous Payments											
G. Payment Due Less Retention						**Contractor Signature and Date:**					
H. Remaining Authorized Amount											

APPENDIX D

Adjacent Projects

Metropolitan Biosolids Center

5240 Convoy Street

San Diego, CA 9211

ATTACHMENT D

CONTRACT FRONT END VOLUME 2

City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

ADDENDUM "1"

REQUEST FOR PROPSAL (RFP)

For

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

RFP NO.:	**5573**
BID NO.:	**K-13-5573-DB2-3**
SAP NO. (WBS/IO/CC):	**S-00339**
CLIENT DEPARTMENT:	**2011**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BO**

PROPOSAL DUE:

12:00 NOON
FEBRARY 20, 2013
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1010 SECOND AVENUE, SUITE 1400, MS 614C
SAN DIEGO, CA 92101

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the RFP 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.

THE SUBMITTAL DATE FOR THIS PROJECT HAS BEEN **EXTENDED AS STATED ABOVE.**

B. CHANGES TO THE REQUEST FOR PROPSAL

1. To RFP, page 10, Section 8.0, Selection and Award Schedule, DELETE in its entirety and SUBSTITUTE with the following:

8.0 SELECTION AND AWARD SCHEDULE

The City anticipates that the process for selecting a Design-Builder, and awarding the contract, will be according to the following tentative schedule:

8.1	Pre-Proposal Meeting	January 16, 2013
8.2	Proposal Due Date	February 20, 2013
8.3	Interviews	February 28, 2013
8.4	Public Ranking Meeting	March 13, 2013
8.5	Selection and Notification	March 27, 2013
8.6	Receipt of Bonds and Insurance Certificates	April 10, 2013
8.7	Notice to Proceed	May 7, 2013

Tony Heinrichs, Director
Public Works Department

Dated: *January 25, 2013*
San Diego, California

TH/nb/egz

City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

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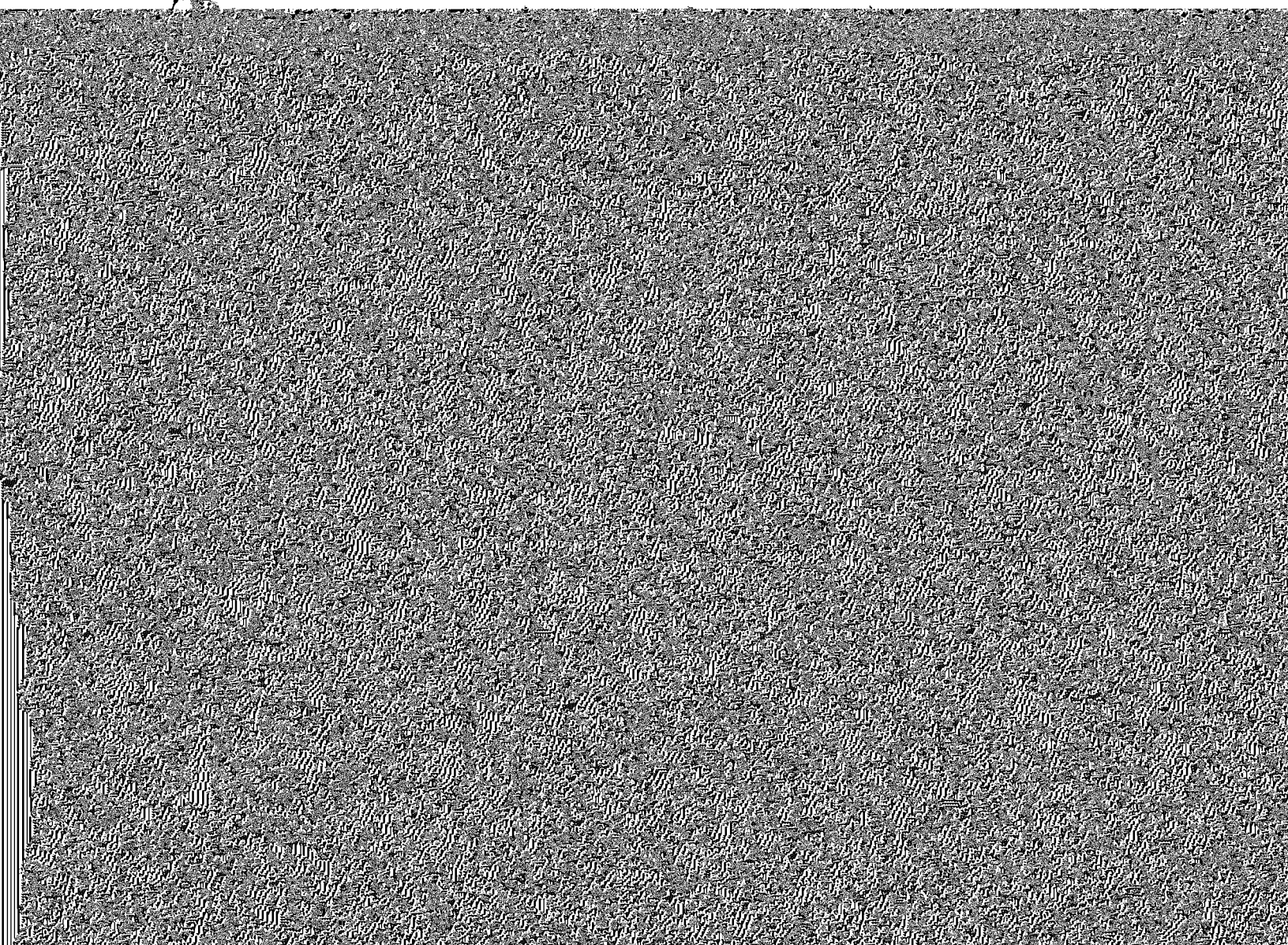
Phone: (619) 533-3482; Fax: (619) 533-3633

ADDENDUM "1"

REQUEST FOR PROPSAL (RFP)

For .



D3. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 11397 – Centrifuges, subsection 2.5, SHOP INSPECTION/SHOP TESTING, Item B, page 85, **DELETE** in its entirety and **SUBSTITUTE** with the following:

Shop testing of the equipment shall be defined as operation of the centrifuge with factory electrical and control systems while feeding potable water to the machine. The purpose of the shop test shall be to test mechanical systems and make necessary adjustments or repairs prior to shipment. If the machine is to be stored at the manufacturer's factory, the shop test shall be successfully completed prior to storage. The centrifuge system shall not be shipped until it has successfully been shop tested.

D4. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 11397 – Centrifuges, subsection 2.5, SHOP INSPECTION/SHOP TESTING, Item C, page 85, **DELETE** in its entirety.

D5. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 11397 – Centrifuges, subsection 2.6, TOOLS AND SPARE PARTS, Item A, Tools, page 85, **DELETE** in its entirety and SUBSTITUTE with the following:

A. **Tools:** The DESIGN-BUILDER shall supply one complete set of special tools for adjustment, disassembly, and service of the centrifuge equipment, as follows:

1. Bowl lifting sling
2. Conveyor lifter
3. Universal tools
4. Wrenches and tool box for disassembly
5. Scroll extracting tool
6. Hydraulic bearing puller

D6. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Technical Specifications, page 311, "Existing Process Flow Diagram (Dewatering)", **DELETE** in its entirety and **SUBSTITUTE** with Page 11 of 13 of this Addendum.

D7. To RFP, ATTACHMENT A, Project Description, Scope Of Work, Technical Specifications, and Bridging Documents, Technical Specifications, page 312, "Centrifuge Modifications Plan and Section", **DELETE** in its entirety and **SUBSTITUTE** with Page 12 of 13 of this Addendum.

D8. To RFP, ATTACHMENT A, Project Description, Scope Of Work, Technical Specifications, and Bridging Documents, Technical Specifications, page 313, "Existing and New Mechanical Details", **DELETE** in its entirety and **SUBSTITUTE** with Page 13 of 13 of this Addendum.

D9. To RFP, ATTACHMENT B, Proposal Submittal Requirements and Selection Criteria, to the last two sentences, page 339, **DELETE** in their entirety and **SUBSTITUTE** with the following:

Total Points: 80

Proposals that do not contain the aforementioned components will not be considered.

D10. To ATTACHMENT C, Contract Front End Volume 1, Special Notice Disadvantage Business Enterprise (DBE), Item 3. SUBCONTRACTING PARTICIPATION PERCENTAGES, page 348, **ADD** the following:

For the purpose of calculating the contract amount to be applied to the subcontracting participation, the amount of the sole source material cost (Alfa Laval Scope of Supply in Attachment A-1) should be subtracted from the total bid amount. The remaining value is the amount that will be used for subcontracting percentages.

D11. To ATTACHMENT C, Contract Front End Volume 1, Invitation to Bids, **ADD** the following:

7. **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.

   The City has determined the following licensing classification(s) for this contract:

   - CLASS A

D12. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 2 – Scope and Control of Work, subsection 2-3.2, Self Performance, page 427, **DELETE** in its entirety and **SUBSTITUTE** with the following:

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

The Contractor shall perform, with its own organization, Contract work amounting to at least **50** percent 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 determining the Apparent Low Bidder as specified, after subtracting the amount of the sole sourced material costs (Alfa Laval Scope of Supply in Attachment A-1). The self performance percentage requirement will be waived for contracts when a "B" License is required or allowed.

D13. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 4 – Control of Materials, subsection 4-2.3, Factory Inspection and Tests, Item A, to the first sentence of the paragraph, page 447, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder shall be responsible for inspection and testing of materials, products, or equipment at the place of manufacture at its own expense when required by the Special Provisions, Regulatory Permits, Codes, or as noted in the plans or specifications.

D14. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 - Prosecution, Progress and Acceptance of Work, subsection 6-8.2.3.4, item D, Sub-item 4, page 456, **DELETE** in its entirety and **SUBSTITUTE** with the following:

4. A schedule for retesting, if necessary. The Design-Builder shall perform any retesting required to fulfill the intent of the Technical Specification test requirements at no additional cost to the Owner.

D15. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 - Prosecution, Progress and Acceptance of Work, subsection 6-8.2.4.2, Owner's Manual Submittal, to the last sentence of the paragraph, page 463, **DELETE** in its entirety and **SUBSTITUTE** with the following:

Any such retention of money for failure to submit the approved Owner's Manual on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the Design-Builder.

D16. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 - Prosecution, Progress and Acceptance of Work, subsection 6-8.2.4.4, Maintenance and Guarantee, Sub-item A, page 464, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder shall comply with the requirements contained in Section 6-8 of the Whitebook.

D17. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 - Prosecution, Progress and Acceptance of Work, subsection 6-8.2.4.5, Bond, page 464, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above.

D18. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 - Prosecution, Progress and Acceptance of Work, subsection 6-9, Liquidated Damages, page 465, **DELETE** the "schedule" in its entirety and **SUBSTITUTE** with the following:

Funding Fiscal Year	Number of Centrifuges	Operational No Later Than
2014	2	476 Calendar Days Following NTP
2014	2	667 Calendar Days Following NTP
2015	2	1092 Calendar Days Following NTP

D19. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 7 - Responsibilities of The Contractor, subsection 7-3, Liability Insurance, **ADD** the following:

7-3.2.5 Contractors Builders Risk Property Insurance.

a) You must provide at your expense, and maintain until Final Acceptance of the Work, a Special Form Builders Risk Policy or Policies. This insurance must be in an amount equal to the replacement cost of the completed Work (without deduction for depreciation) including the cost of excavations, grading, and filling. The policy or policies limits must be 100% of this contract value of the Work plus 15% to cover administrative costs, design costs, and the costs of inspections and construction management.

b) Insured property must include material or portions of the Work located away from the Site but intended for use at the Site, and must cover material or portions of the Work in transit. The policy or policies must include as insured property scaffolding, falsework, and temporary buildings located at the Site. The policy or policies must cover the cost of removing debris, including demolition.

c) The policy or policies must provide that all proceeds thereunder must be payable to the City as Trustee for the insured, and must name the City, you, Subcontractors, and Suppliers of all tiers as named insured. We as Trustee will collect, adjust, and receive all monies which may become due and payable under the policy or policies, may compromise any and all claims thereunder, and will apply the proceeds of such insurance to the repair, reconstruction, or replacement of the Work.

d) Any deductible applicable to the insurance must be identified in the policy or policies documents and responsibility for paying the part of any loss not covered because of the application of such deductibles must be apportioned among the parties except for the City as follows: if there is more than one claimant for a single occurrence, then each claimant must pay a pro-rata share of the per occurrence deductible based upon the percentage of their paid claim to the total paid for insured. The City must be entitled to 100% of its loss. You must pay the City any portion of that loss not covered because of a deductible, at the same time the proceeds of the insurance are paid to the City as trustee.

e) Any insured, other than the City, making claim to which a deductible applies must be responsible for 100% of the loss not insured because of the deductible. 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.

7-3.5.5 Builders Risk Endorsements.

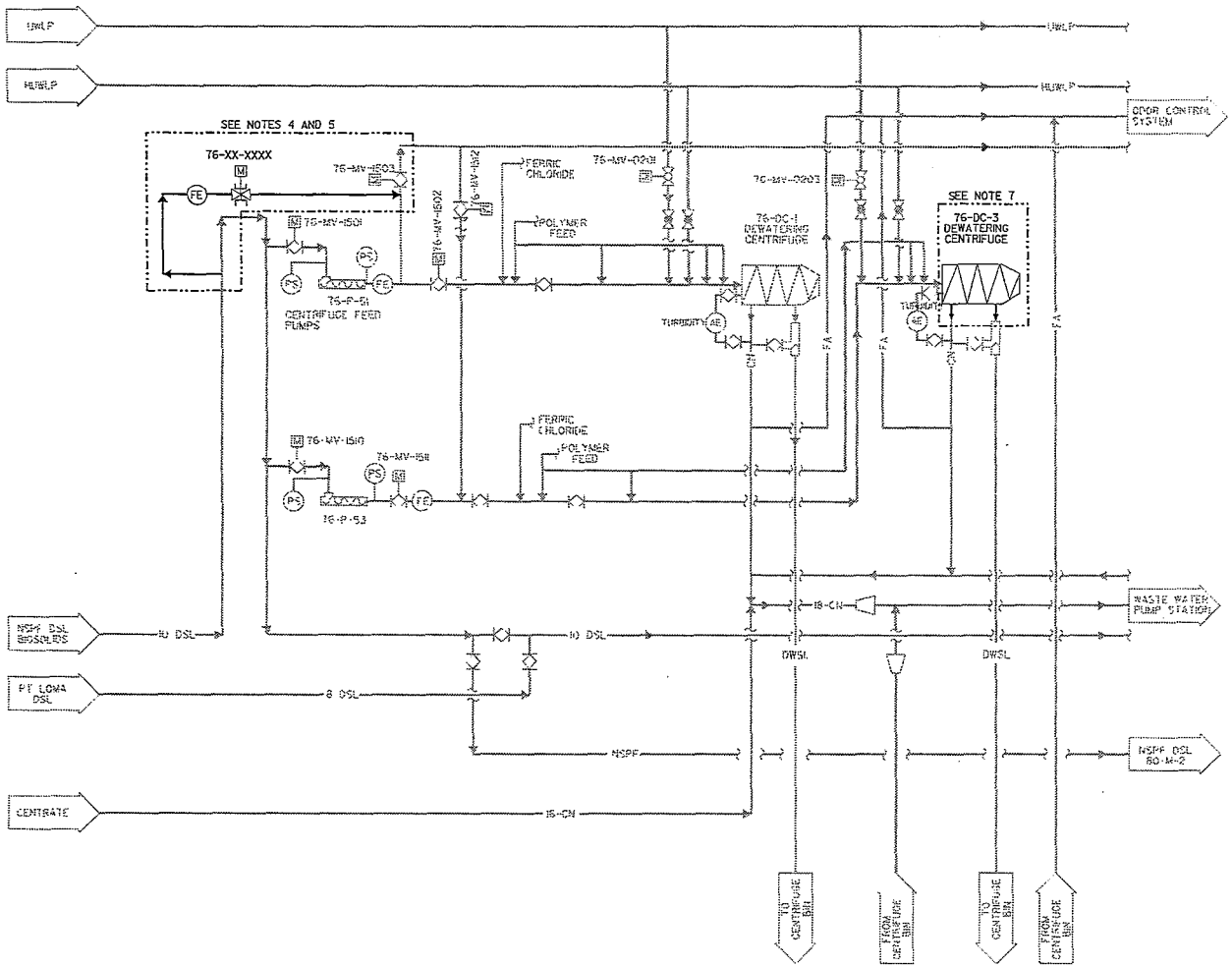
7-3.5.5.1 Waiver of Subrogation. The policy or policies must be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from work performed by the Named Insured for the City.

7-3.5.5.2 Builders Risk – Partial Utilization. If the City desire to occupy or use a portion or portions of the Work prior to Acceptance in accordance with this contract, the City will notify you and you must immediately notify your Builder's Risk insurer and obtain an endorsement that the policy or policies must not be cancelled or lapse on account of any such partial use or occupancy. You must obtain the endorsement prior to our occupation and use.

Tony Heinrichs, Director
Public Works Department

Dated: *January 30, 2013*
San Diego, California

TH/nb/egz



NOTES:

1. THE DESIGN-BUILDER SHALL REPLACE DEWATERING CENTRIFUGES 76-DC-2 THROUGH 76-DC-7. SEE SPECIFICATION SECTION 11397.
2. FOR LOCATIONS OF LOCAL CONTROL PANELS (LCP) SEE FIGURE 2 OF 8.
3. PROCESS FLOW DIAGRAM IS FOR ILLUSTRATION. SEE RECORD DRAWINGS 27329-0155-D (SHEET 76-M-4) AND 27329-0156-D (SHEET 76-M-5) FOR COMPLETE PROCESS FLOW DIAGRAM.
4. THE DESIGN-BUILDER SHALL FIELD LOCATE AND INSTALL MOTORIZED PINCH DIAPHRAGM VALVE AND FLOW ELEMENT AS SHOWN AT DEWATERING CENTRIFUGE (76-DC-1) FEED PUMP.
5. THE DESIGN-BUILDER SHALL ALSO FIELD LOCATE AND INSTALL MOTORIZED PINCH VALVE AND FLOW METER AT DEWATERING CENTRIFUGE 8 (76-DC-8) FEED PUMP (NOT SHOWN).
6. THE HEAT EXCHANGERS AND HOT WATER SUPPLY SYSTEM HAVE BEEN REMOVED FROM THE EXISTING PROCESS.
7. REPLACE DEWATERING CENTRIFUGE AND PORTIONS OF CENTRATE AND SOLIDS PIPING NECESSARY FOR CONNECTING TO EXISTING CENTRATE AND SOLIDS CONVEYANCE SYSTEMS. SEE FIGURE 5 FOR DETAIL VIEW.

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
EXISTING PROCESS FLOW DIAGRAM (DEWATERING)

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 3 OF 8

WATER WBS N/A
SEWER WBS S-00339

P:\Projects\San Diego, City of (CA)_MWWD 2008-2011 As-Needed\141566 - MBC Centrifuge Replacement\CADD\10-FIGURES\S00339-FIGURE 3.dgn
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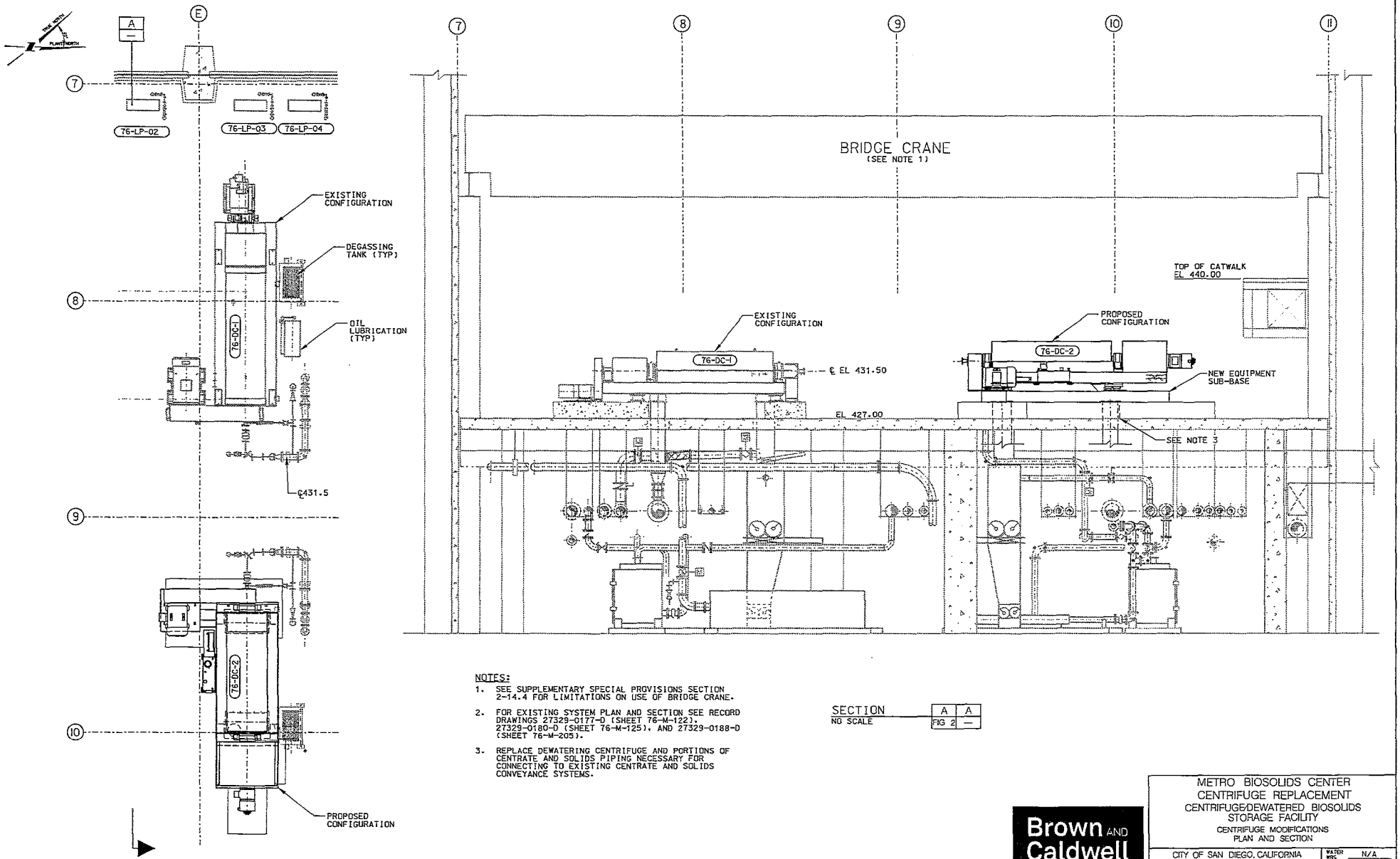

NOTES:

1. SEE SUPPLEMENTARY SPECIAL PROVISIONS SECTION 2-14.4 FOR LIMITATIONS ON USE OF BRIDGE CRANE.
2. FOR EXISTING SYSTEM PLAN AND SECTION SEE RECORD DRAWINGS 27329-0177-D (SHEET 76-M-122), 27329-0180-D (SHEET 76-M-125), AND 27329-0188-D (SHEET 76-M-205).
3. REPLACE DEWATERING CENTRIFUGE AND PORTIONS OF CENTRATE AND SOLIDS PIPING NECESSARY FOR CONNECTING TO EXISTING CENTRATE AND SOLIDS CONVEYANCE SYSTEMS.

SECTION A A
NO SCALE FIG 2 —

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
CENTRIFUGE MODIFICATIONS
PLAN AND SECTION

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 4 OF 8

WATER WBS N/A
SEWER WBS S-00339

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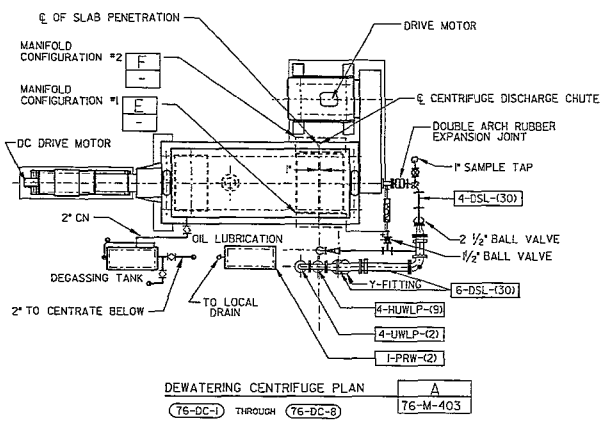
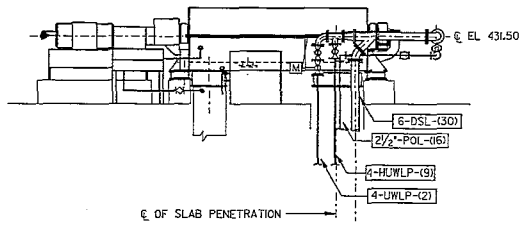
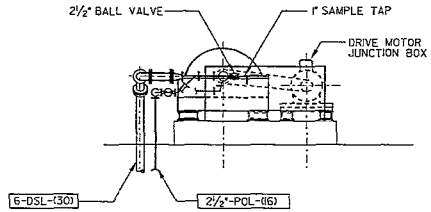


DEWATERING CENTRIFUGE PLAN — A / 76-M-403

(76-DC-1) THROUGH (76-DC-8)



SIDE VIEW — 1 / 76-M-403



FRONT VIEW — 2 / 76-M-403

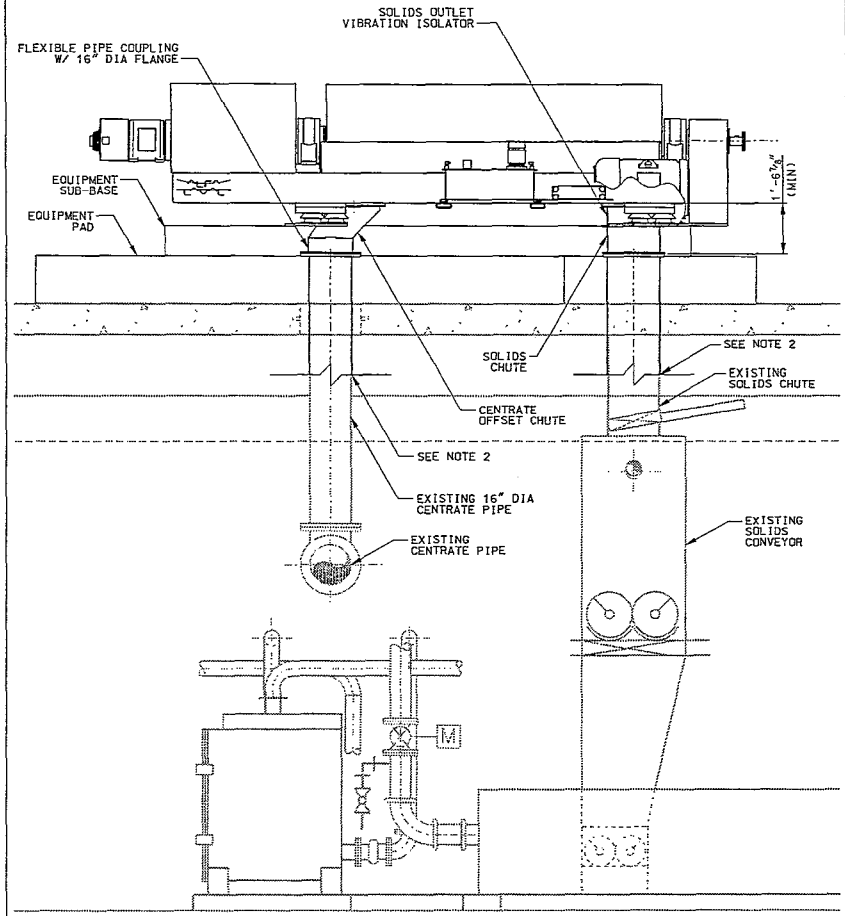
RECORD DRAWING FROM WHICH DETAIL WAS REFERENCED (TYP)

NOTES:

1. ALL PIPING WILL BE SCHEDULE 80 PVC
2. PVC HOSE WILL BE 2" CLEAR VIEW REINFORCED PVC HOSE CAPABLE OF A WORKING PRESSURE OF 125 PSI. THE PVC HOSE WILL BE LONG ENOUGH SO AS NOT TO INDUCE STRESS ON THE PVC PIPING SUPPORTED BY THE CENTRIFUGE.
3. ADJUST ISOLATION BALL VALVES TO PROVIDE A FLOW OF 30 GPM TO THE THREE FLUSH CONNECTION PORTS.

EXISTING CENTRIFUGE DETAILS

PER RECORD DRAWING 23729-0194-D (SHEET 76-M-403)



NOTES:

1. SECTION VIEW AS SHOWN IS ONLY A REPRESENTATION OF POSSIBLE EQUIPMENT ORIENTATION AND CONNECTION TO EXISTING PIPING AND SOLIDS CONVEYANCE SYSTEMS. THE DESIGN-BUILDER SHALL CONSULT WITH THE CENTRIFUGE MANUFACTURER FOR POSSIBLE CONFIGURATIONS AND FIELD VERIFY ALL DIMENSIONS, PIPING, SLAB OPENINGS, ETC. DURING THE DESIGN AND PROSECUTION OF THE WORK.
2. EXTENT OF NEW PIPING IS ONLY A REPRESENTATION. THE DESIGN-BUILDER SHALL FIELD VERIFY AND DETERMINE POINTS OF CONNECTION.

NEW CENTRIFUGE

DETAIL 1 / NO SCALE —

Brown AND Caldwell

METRO BIOSOLIDS CENTER
CENTRIFUGE REPLACEMENT
CENTRIFUGE/DEWATERED BIOSOLIDS STORAGE FACILITY
EXISTING AND NEW MECHANICAL DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
FIGURE 5 OF 8

WATER WBS N/A
SEWER WBS S-00339

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City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

ADDENDUM "3"

REQUEST FOR PROPSAL (RFP)

For

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

RFP NO.:	5573
BID NO.:	K-13-5573-DB2-3
SAP NO. (WBS/IO/CC):	S-00339
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	7
PROJECT TYPE:	BO

PROPOSAL DUE:

12:00 NOON
FEBRUARY 26, 2013
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1010 SECOND AVENUE, SUITE 1400, MS 614C
SAN DIEGO, CA 92101

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the RFP 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.

THE SUBMITTAL DATE FOR THIS PROJECT HAS BEEN **EXTENDED AS STATED ABOVE.**

B. CLARIFICATIONS

B1. All prospective bidders are reminded that they are required to acknowledge receipt of this addendum in their submittal in accordance with ATTACHMENT C, Instructions to Bidders, Item 3 of the Request for Proposal.

B2. Refer to the FTP website for operational data for the centrifuge feed conditions: ftp://ftp.sannet.gov/OUT/ECP/2-7%20SUBSURFACE%20DATA/K-13-5573-DB2-3%20S-00339%20MBC-Dewatering%20Centrifuges%20Replacement%20DB%20Contract/

B3. The following clarification is issued for Addendum 2, Part C. Questions and Answers, A21.

Each bond will be in effect from beginning of the respective phase to the end of the entire project (i.e. NOC).

C. REVISIONS TO ADDENDUM 2

C1. To Bid No. K-12-5573-DB2-3, page 1, DELETE in its entirety and SUBSTITUTE with the following:

K-13-5573-DB2-3

C2. To D. Changes to the Request for Proposal, D18, Page 9 of 13, DELETE in its entirety and SUBSTITUTE the following:

To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 – Prosecution, Progress and Acceptance of Work, subsection 6-9, Liquidated Damages, page 465, **DELETE** in its entirety and **SUBSTITUTE** with the following:

6-9 LIQUIDATED DAMAGES. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

MODIFY to increase the daily value from $250 to $500.

All WORK under this Contract shall be completed within 920 Calendar Days from the date of issuance of the Design Notice to Proceed. It is the intent of this contract to make beneficial use of the centrifuges as soon as they are delivered to site, installed and

accepted. The DESIGN-BUILDER will be assessed liquidated damages if a centrifuge is not available for beneficial use to the CITY within 120 calendar days of delivery to the site. Where more than one centrifuge is delivered at the same time, liquidated damages will be assessed based on each centrifuge being installed and accepted over a 120 calendar day period per centrifuge. Liquidated damages will also be assessed, per centrifuge, in the event that record drawings are not submitted prior to final acceptance. The centrifuges shall be procured by the DESIGN-BUILDER and shall be fully operational following installation and acceptance testing per the schedule below.

Funding Fiscal Year	Number of Centrifuges	Operational No Later Than
2014	2	590 Calendar Days Following NTP
2014	2	710 Calendar Days Following NTP
2015	2	830 Calendar Days Following NTP

Failure to complete the WORK within the Contract Time and the above schedule will result in damages being assessed by the City.

D. RESPONSES TO QUESTIONS:

Responses to questions received from Design-Builders are provided below.

Q1. Reference RFP, Page 441, Paragraph 2-5.3.11.A Record Drawings. The last sentence of the second paragraph references Article 3 of the Agreement. We are unable to find any reference to Article 3 of the Agreement in the RFP, the Greenbook, or the Whitebook. Please provide a copy of this Article of the Agreement.

A1. Refer to E. Changes to the Request for Proposal, sub-item E9 and Section C. Revisions to Addendum 2 of this Addendum.

Q2. Reference RFP, Page 463, Paragraph 6-8.2.4.2 Owner's Manual Submittal. Paragraph A references Article 14 of the General Conditions. We are unable to find any reference to Article 14 of the General Conditions in the RFP, the Greenbook or the Whitebook. Please provide a copy of this Article of the General Conditions.

A2. Refer to E. Changes to the Request for Proposal, sub-item E11 of this Addendum.

Q3. Reference RFP, Page 464, Paragraph 6-8.2.4.4.A Maintenance and Guarantee. Paragraph A references Article 13 of the General Conditions. We are unable to find any reference to Article 13 of the General Conditions in the RFP, the Greenbook or the Whitebook. Please provide a copy of this Article of the General Conditions.

A3. Refer to D. Changes to the Request for Proposal, sub-item D16 of Addendum 2.

Q4. Reference RFP, Page 464, Paragraph 6-8.2.4.5 Bond. Paragraph A references Article 13 of the General Conditions. We are unable to find any reference to Article 13 of the General Conditions in the RFP, the Greenbook or the Whitebook. Please provide a copy of this Article of the General Conditions

A4. Refer to D. Changes to the Request for Proposal, sub-item D17 of Addendum 2.

Q5. In the special conditions, Section 10.10 Project Schedule currently shows startup of the first (2) centrifuges by June 2014. Per discussions at the pre-proposal meeting, the City is expected to modify the requirements such that (4) centrifuges are to be installed by June 2014. There is concern over the ability to meet this milestone. Alfa Laval has listed lead times of 12 weeks and 30 weeks for equipment submittals and fabrication and delivery. There will be additional durations for the design/build team and the city to review and approve the submittals. During construction, only one centrifuge can be taken out of service, limiting our ability to expedite the schedule. Please advise.

A5. Refer to Answer A16 and Section C. Revisions to Addendum 2 of this Addendum.

Q6. Attachment A, Section 2.0.b indicates that no more than one centrifuge is to be taken out of service at one time. Please confirm this requirement. Per the pre-proposal meeting discussion, #3 and #6 will be replaced first, one at a time. After this, will the contractor be able to take 2 centrifuges out of service at a time? If so, can startup and testing occur concurrently?

A6. Yes. Centrifuges #3 and #6 shall be replaced first. No more than one (1) unit shall be out of service at a time. After replacements for centrifuges #3 and #6 have been installed, tested, and accepted, more than one centrifuge may be replaced at a time. Refer to E. Changes to the Request for Proposal, sub-items E1, E2, E3 and E13 of this Addendum.

Q7. Section 11397 Paragraph 2.2.A.3 – please confirm the feed solids concentration is expressed in **Total** Solids (%TS)

A7. Yes. The feed solids concentration is expressed in (%TS).

Q8. Section 11397 Paragraph 2.2.A.6 – please confirm both the maximum allowable polymer dosage in *polymer dry active pounds/dry ton of sludge TS* and the concentration of the "make-up" polymer solution on a dry weight basis.

A8. The Design-Builder shall determine maximum allowable polymer dosage in consultation with the City centrifuge manufacturer during prosecution of the work. The current polymer dosage is provided below for reference only.

Polymer:	Clarifloc WE-453 supplied by Polydyne
Active Solids:	3.5% by weight of polymer
Active Solids Conc:	0.2% by weight, approximate (2990 gal water mixed with 210 gal polymer)
Dosage:	0.05:1 ratio of "make-up" polymer solution to sludge, by weight

Q9. Section 11397 Paragraph 3.2.C – confirm that there are no performance requirements relative to "Volatile Solids Concentration"

A9. There are no performance requirements with regard to volatile solids.

Q10. With respect to Section 11397 2.6.B.5, there are no inspection port fasteners on the current equipment and thus no spares will be included in the scope of supply.

A10. Specification Section 11397, 2.6.B sub-item 5 has been deleted. Refer to E. Changes to the Request for Proposal, sub-item E4 of this Addendum.

Q11. Please provide information on the quantity and type of lubricants that the contractor will need to supply for each new centrifuge.

A11. The Design-Builder shall determine the quantity and types of lubricants in consultation with Alfa Laval during design.

Q12. Does MBC currently experience any problems with "struvite" that would require mitigation?

A12. No, MBC does not have any struvite problems at the centrifuge.

Q13. What is the estimated heat generation of the proposed new control panels?

A13. Per manufacturer's representative, the heat generation is 26,000 BTU, requiring 817 cfm of air flow (NEMA 12).

Q14. Please provide pump curves (flow rate versus TDH) for the *sludge feed pumps* and the *polymer solution feed pumps*. Does the city have hydraulic calculations used to determine the TDH at the required flow rates? Is there information available on the maximum allowable backpressure through the centrifuge feed tube assembly under the maximum flows (sludge flow plus polymer solution flow)? What is the assumed viscosity of the polymer solution?

A14. Pump curves, data sheets, and inspection certificates are available on the City's FTP site. The City has not prepared hydraulic calculations for determining TDH. Information on backpressure and viscosity is not available. Refer to the pump inspection certificates for viscosity assumed by the manufacturer.

Q15. Addendum No. 2, Item D.18 states 4 centrifuges are to be funded in Fiscal year 2014. Please verify Fiscal Year 2014 starts July 1, 2013.

A15. Fiscal Year 2014 starts on July 1, 2013.

Q16. Addendum No. 2, Item D.18 states the first two centrifuges are to be operational no later than 476 Calendar days following NTP. The City has allowed 120 days (Section 6, Subsection 6-9 (page 465) of the RFP) from delivery for installation of each centrifuge. To allow the time required by Alfa Laval to deliver the centrifuges to the site and the additional 120 days for each centrifuge, the first two centrifuges would not be operational until 550 days following NTP. Addendum No. 2 requires the second set of centrifuges to be operational no later than 667 calendar days from NTP. Again with 120 days for installation of each centrifuge, the earliest these centrifuges can be operational is 550 days plus 240 days or 790 days. Please verify the required period

for operation of the first 2 centrifuges will be changed to 534 days and the required period for operation of the second 2 centrifuges will be changed to 774 days.

A16. The schedule on page 465 has been updated to account for installation of the first two centrifuges one at a time. The RFP has been modified to allow removal of more than one centrifuge after the first two are in operation. Therefore, replacement centrifuges after the first two do not need to be installed one at a time. Refer to Section C. Revisions to Addendum 2, and E. Changes to the Request for Proposal, sub-items E1, E2, and E3 of this Addendum.

Q17. The specifications require the good faith effort be submitted within 4 working days after the bid opening. Is the 4 days from the proposal due date or the public ranking meeting?

A17. Yes, no later than 4 days following the proposal due date.

Q18. Will the City require factory witness testing at the place of manufacture? If so, how many staff members would attend?

A18. No, City will not attend factory testing. Refer to D. Changes to the Request for Proposal, sub-items D4 of Addendum 2.

Q19. Does this contract require "buy American" for equipment and material purchases?

A19. No, however whenever possible it is advisable to buy American.

Q20. The availability of operational data for the centrifuge feed conditions will be very beneficial for the preparation of our proposal. Please provide 1 year of the following daily operational information:

a. Centrifuge feed total solids
b. Centrifuge feed volatile solids
c. Historical cake solids concentrations
d. Historical data of the ratio of primary sludge to digested sludge or average flow rate for primary sludge and digested sludge with corresponding primary and digested solids concentrations.
e. Pounds of active polymer per dry ton of solids processed
f. Polymer dosing rates

A20. Information available has been placed on City's FTP site B2 of this Addendum. For answers to question subparts e and f, refer to A8 of this Addendum.

Q21. Please reference Page 462 of the RFP, Paragraph 6-8.2.3.10.B.10; please clarify the reference to the requirement for the Functional Test Schedule to allow no less than 120 days to complete the Functional Test Program. What is the Functional Test Program? When is it supposed to occur? How does a 120 day functional test fit into the testing and startup schedule outlined by the City which is not suppose to extend beyond 30 days plus 48 hours?

A21. The requirement to allow "no less than 120 days" has been removed. The test program consists of the different functional tests, where required, as described in the technical specifications and contract documents. It is anticipated that installation, functional testing, startup and final acceptance will occur within the 120-day time period between centrifuge delivery and final acceptance. See E10 of this addendum.

Q22. Is there a page limit for the proposal? If so, what is included and what is not included in the page count?

A22. There is no page limit for the proposal.

Q23. Can the design builder use the existing conduit or spare conduit for this project?

A23. Design builder shall utilize existing conduits as specified in Figure 6 notes (Attachment A, page 314). The use of available spare conduits is also permitted when required.

Q24. Can the design builder re-use the existing conductors/cables?

A24. No, the use of existing conductors/cables is not permitted.

Q25. On page 470, 6-8.2.3.9 System Loop Checks reference is made to the Control Systems Provider? Is the Control Systems Provider part of the design build team or contracted by the City?

A25. The Control Systems Provider referenced shall be part of the Design-Build Team.

E. CHANGES TO THE REQUEST FOR PROPOSAL

E1. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 1.0, Project Description, page 15, **DELETE** in its entirety and **SUBSTITUTE** with the following:

1.0 Project Description:

This project is subject to phased funding. Four (4) centrifuges shall be funded in fiscal year (FY) 2014, and two (2) more shall be funded in fiscal year FY 2015. During replacement of the first two centrifuges, no more than one (1) unit shall be taken out of the service at a time. (Required to maintain dewatering capacity). Refer to section 2.0 – Scope of Work for more details.

E2. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 2.0, Scope of Work, sub-item "b", page 15, **DELETE** in its entirety and **SUBSTITUTE** with the following:

b. Removal and salvage of existing centrifuges. During replacement of the first set of two centrifuges, no more than one centrifuge shall be taken out of service. Following installation, testing, and acceptance of the first set of two replacement centrifuges, and after they have been turned over to the City, Design-Builder may

take more than one centrifuge out of service for installing the remaining centrifuges. Refer to Section 7-18.b for Design-Builder responsibilities.

E3. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 2.0, Scope of Work, sub-item "g", page 15, **DELETE** in its entirety and **SUBSTITUTE** with the following:

g. Installation of six new dewatering centrifuges including all appurtenances. In order to retain dewatering capacity, no more than one centrifuge shall be taken out of service when installing the first set of two centrifuges. Following installation, testing and acceptance of the first set of two replacement centrifuges, and after they have been turned over to the Owner, Design-Builder may take more than one centrifuge out of service for installing the remaining centrifuges.

E4. To RFP, ATTACHMENT A, Project Description, Scope of Work, Technical Specifications, and Bridging Documents, Section 11397 – Centrifuges, Section 2.6, Tools and Spare Parts, sub-item B, Spare Parts, page 86, **DELETE** in its entirety and **SUBSTITUTE** with the following:

B. **Spare Parts**: The following spare parts shall be included for each centrifuge installed:

1. One complete set of O-rings, seals and gaskets
2. One set of main bearings and scroll conveyor bearings
3. One set of main drive belts
4. One revolution of sintered tungsten-carbide tiles (approximately 30 tiles)
5. Two sets of case cover fasteners
6. One set of weir plate fasteners
7. One vibration sensor
8. One main bearing temperature sensor
9. One set of solids discharge port replaceable tungsten-carbide wear plates
10. One set of all flexible connectors
11. One set of replaceable conveyor inlet port liner

E5. To ATTACHMENT C, Contract Front End Volume 1, Funding Agency Provisions for Construction Contractor Requirements, Item 10, Wage Rates, pages 366 through 391, DELETE in their entirety and SUBSTITUTE with Pages 12 of 40 through 37 of 40 of this Addendum.

E6. To ATTACHMENT C, Contract Front End Volume 1, Contract Forms Agreement, pages 417 through 418, DELETE in their entirety and SUBSTITUE with Pages 38 of 40 through 39 of 40 of this Addendum.

E7. To ATTACHMENT C, Contract Front End Volume 1, Contract Forms, Faithful Performance Bond and Labor and Materialmen's Bond, page 419, **DELETE** in its entirety and **SUBSTITUTE** with Page 40 of 40 of this Addendum.

E8. To ATTACHMENT C, Contract Front End Volume 1, Phased Funding Schedule Agreement, page 425, **DELETE** the "table" in its entirety and **SUBSTITUTE** with the following:

Funding Phase	Phase Description	Phase Start	Phase Finish	Not-to-Exceed Amount
1	Mobilization, procurement, installation, testing, and acceptance of 2 centrifuges, installation of pinch valves, and initiation of procurement of 2 additional centrifuges.			
2	Completion of procurement, installation, testing, and acceptance of second set of 2 centrifuges, and initiation of procurement of final set of 2 centrifuges.			
3	Completion of procurement, installation, testing, and acceptance of final set of 2 centrifuges, demobilization, and project closeout.			
Total				

E9. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 2 – Scope and Control of Work, subsection 2-5.3.11 Record Drawings, Item A, Second Paragraph, page 441, **DELETE** in its entirety and **SUBSTITUTE** with the following:

Copies of the record drawings shall be submitted prior to final acceptance for each centrifuge. Failure to submit complete record drawings shall enact the liquidated damages as described in Section 6-9.

E10. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 – Prosecution, Progress and Acceptance of Work, subsection 6-8.2.3.10, Functional Testing, page 461, Item B, sub-item10, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder shall develop a Test Schedule for Functional Testing.

E11. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 6 – Prosecution, Progress and Acceptance of Work, subsection 6-8.2.4.2 Owner's Manual Submittal, page 463, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder's attention is directed to the condition that neither final payment nor release of retention shall become due, per Section 9 of the Whitebook, if at the 75 percent construction completion point, the approved Owner's Manual complying with Section 2-5.3.7 has not been submitted. The aforementioned amount will be

retained by the Owner as the agreed, estimated value of the approved Owner's Manuals. Any such retention of money for failure to submit the approved Owner's Manuals on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the Design-Builder.

E12. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 7 – Responsibilities of the Contractor, subsection 7-3 Liability Insurance, **ADD** the following:

ADD: 7-3.10 Architects and Engineers Professional Insurance (Errors and Omissions Insurance).

a) For contracts with required engineering services (e.g., Design-Build, preparation of engineered Traffic Control Plans (TCP), etc. by you) for all of your employees or Subcontractors who provide professional engineering services under this contract, you must keep or must require your Subcontractor keep in full force and effect, Professional Liability coverage with a limit of **$1,000,000** per claim and **$2,000,000** annual aggregate.

b) You must ensure both that: (a) the policy retroactive date is on or before the date of commencement of the Project; and (b) the policy will be maintained in force for a period of 3 years after completion of the Project or termination of this contract whichever occurs last. You agree that for the time period specified above, there will be no changes or endorsements to the policy that affect the specified coverage.

c) If professional engineering services are to be provided solely by the Subcontractor, you must (a) certify this to the City in writing and (b) agree in writing to require the Subcontractor to procure Professional Liability coverage in accordance with the requirements set forth above.

E13. To ATTACHMENT C, Contract Front End Volume 1, Supplementary Special Provisions (SSP), Section 7 – Responsibilities of the Contractor, subsection 7-18 b Design-Builder's Responsibilities, page 470, **DELETE** in its entirety and **SUBSTITUTE** with the following:

The Design-Builder must sequence the removal and replacement of the centrifuges. Due to plant operating constraints only one centrifuge may be taken out of operation at any one time until the first set of two centrifuges has been installed, tested, accepted and turned over to the OWNER. During replacement of the first set of two centrifuges, the DESIGN-BUILDER must completely replace a centrifuge and completely start up, commission and turn over to the OWNER per the contract documents before the next centrifuge replacement can be started.

Following installation, testing and acceptance of the first set of two centrifuges, and after they have been turned over to the owner, the DESIGN-BUILDER may take more than one centrifuge out of service. The DESIGN-BUILDER must also conform to the phase funding requirements of this contract. The order of replacement of centrifuges must be coordinated with operations during the preconstruction meeting defined in these documents.

Tony Heinrichs, Director
Public Works Department

Dated: *February 12, 2013*
San Diego, California

TH/nb/egz

10. WAGE RATES. This contract shall be subject to the following Davis-Bacon Wage Decision:

General Decision Number: CA130001 01/18/2013 CA1

Superseded General Decision Number: CA20120001

State: California

Construction Types: Building, Heavy (Heavy and Dredging), Highway and Residential

County: San Diego County in California.

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS; RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/04/2013
1	01/18/2013

ASBE0005-002 06/28/2010

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems)	$ 32.79	16.31
Fire Stop Technician (Application of Firestopping Materials for wall openings and penetrations in walls, floors, ceilings and curtain walls)	$ 24.21	13.76

ASBE0005-004 06/28/2010

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)	$ 18.70	8.65

BOIL0092-003 05/01/2011

	Rates	Fringes
BOILERMAKER	$ 41.26	25.27

BRCA0004-008 11/01/2012

	Rates	Fringes
BRICKLAYER; MARBLE SETTER	$ 33.75	14.55

BRCA0018-004 06/01/2012

	Rates	Fringes
MARBLE FINISHER	$ 27.04	10.66
TILE FINISHER	$ 22.37	9.19
TILE LAYER	$ 33.55	13.55

BRCA0018-010 09/01/2009

	Rates	Fringes
TERRAZZO FINISHER	$ 26.59	9.62
TERRAZZO WORKER/SETTER	$ 33.63	10.46

CARP0409-002 07/01/2008

	Rates	Fringes
Diver		
(1) Wet	$ 663.68	9.82
(2) Standby	$ 331.84	9.82
(3) Tender	$ 323.84	9.82
(4) Assistant Tender	$ 299.84	9.82

Amounts in "Rates' column are per day

CARP0409-008 08/01/2010

	Rates	Fringes
Modular Furniture Installer	$ 17.00	7.41

CARP0547-001 07/01/2009

	Rates	Fringes
CARPENTER		
(1) Bridge	$ 37.28	10.58
(2) Commercial Building	$ 32.30	10.58
(3) Heavy & Highway	$ 37.15	10.58
(4) Residential Carpenter	$ 25.84	10.58
(5) Residential Insulation Installer	$ 18.00	8.16
MILLWRIGHT	$ 37.65	10.58
PILEDRIVERMAN	$ 37.28	10.58

CARP0547-002 07/01/2009

	Rates	Fringes
Drywall		
(1) Work on wood framed construction of single family residences, apartments or condominiums under four stories		
Drywall Installer/Lather	$ 21.00	8.58
Drywall Stocker/Scrapper	$ 11.00	6.67
(2) All other work		
Drywall Installer/Lather	$ 27.35	9.58
Drywall Stocker/Scrapper	$ 11.00	6.67

ELEC0569-001 08/27/2012

	Rates	Fringes
Electricians (Tunnel Work)		
Cable Splicer	$ 43.05	3%+11.87
Electrician	$ 42.30	3%+11.87
Electricians: (All Other Work, Including 4 Stories		

Residential)

Cable Splicer	$ 38.35	3%+11.87
Electrician	$ 37.60	3%+11.87

ELEC0569-005 12/01/2012

	Rates	Fringes
Sound & Communications		
Sound Technician	$ 27.57	3%+10.81
Soundman	$ 22.06	3%+9.17

SOUND TECHNICIAN: Terminating, operating and performing final check-out

SOUNDMAN: Wire-pulling, splicing, assembling and installing devices

SCOPE OF WORK Assembly, installation, operation, service and maintenance of components or systems as used in closed circuit television, amplified master television distribution, CATV on private property, intercommunication, burglar alarm, fire alarm, life support and all security alarms, private and public telephone and related telephone interconnect, public address, paging, audio, language, electronic, background music system less than line voltage or any system acceptable for class two wiring for private, commercial, or industrial use furnished by leased wire, frequency modulation or other recording devices, electrical apparatus by means of which electricity is applied to the amplification, transmission, transference, recording or reproduction of voice, music, sound, impulses and video. Excluded from this Scope of Work - transmission, service and maintenance of background music. All of the above shall include the installation and transmission over fiber optics.

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* ELEC0569-006 10/01/2012

Work on street lighting; traffic signals; and underground systems and/or established easements outside of buildings

	Rates	Fringes
Traffic signal, street light and underground work		
Utility Technician #1	$ 27.25	3%+7.27
Utility Technician #2	$ 22.40	3%+7.27

STREET LIGHT & TRAFFIC SIGNAL WORK:

UTILITY TECHNICIAN #1: Installation of street lights and traffic signals, including electrical circuitry, programmable controller, pedestal-mounted electrical meter enclosures and laying of pre-assembled cable in ducts. The layout of electrical systems and communication installation including proper position of trench depths, and radius at duct banks, location for manholes, street lights and

traffic signals.

UTILITY TECHNICIAN #2: Distribution of material at jobsite, installation of underground ducts for electrical, telephone, cable TV land communication systems. The setting, leveling, grounding and racking of precast manholes, handholes and transformer pads.

ELEC0569-008 06/01/2011

	Rates	Fringes
ELECTRICIAN (Residential, 1-3 Stories)	$ 22.37	3%+2.90

ELEC1245-001 06/01/2012

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer	$ 48.95	14.05
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment)	$ 39.09	12.97
(3) Groundman	$ 29.91	12.70
(4) Powderman	$ 43.71	13.15

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ELEV0018-001 01/01/2012

	Rates	Fringes
ELEVATOR MECHANIC	$ 47.73	23.535

FOOTNOTE:
PAID VACATION: Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.
PAID HOLIDAYS: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0012-003 07/01/2012

	Rates	Fringes
OPERATOR: Power Equipment (All Other Work)		
GROUP 1	$ 37.40	20.00
GROUP 2	$ 38.18	20.00

GROUP 3	$ 38.47	20.00
GROUP 4	$ 39.96	20.00
GROUP 5	$ 41.06	20.00
GROUP 6	$ 40.18	20.00
GROUP 8	$ 41.39	20.00
GROUP 9	$ 40.41	20.00
GROUP 10	$ 40.41	20.00
GROUP 11	$ 40.58	20.00
GROUP 12	$ 40.58	20.00
GROUP 13	$ 40.68	20.00
GROUP 14	$ 40.71	20.00
GROUP 15	$ 40.79	20.00
GROUP 16	$ 40.91	20.00
GROUP 17	$ 41.08	20.00
GROUP 18	$ 41.18	20.00
GROUP 19	$ 41.29	20.00
GROUP 20	$ 41.41	20.00
GROUP 21	$ 41.58	20.00
GROUP 22	$ 41.68	20.00
GROUP 23	$ 41.79	20.00
GROUP 24	$ 41.91	20.00
GROUP 25	$ 42.08	20.00

OPERATOR: Power Equipment
(Cranes, Piledriving &
Hoisting)

GROUP 1	$ 38.75	20.00
GROUP 2	$ 39.53	20.00
GROUP 3	$ 39.82	20.00
GROUP 4	$ 39.96	20.00
GROUP 5	$ 40.18	20.00
GROUP 6	$ 40.29	20.00
GROUP 7	$ 40.41	20.00
GROUP 8	$ 40.58	20.00
GROUP 9	$ 40.75	20.00
GROUP 10	$ 41.75	20.00
GROUP 11	$ 42.75	20.00
GROUP 12	$ 43.75	20.00
GROUP 13	$ 44.75	20.00

OPERATOR: Power Equipment
(Tunnel Work)

GROUP 1	$ 39.25	20.00
GROUP 2	$ 40.03	20.00
GROUP 3	$ 40.32	20.00
GROUP 4	$ 40.46	20.00
GROUP 5	$ 40.68	20.00
GROUP 6	$ 40.79	20.00
GROUP 7	$ 40.91	20.00

PREMIUM PAY:
$3.75 per hour shall be paid on all Power Equipment Operator work on the followng Military Bases: China Lake Naval Reserve, Vandenberg AFB, Point Arguello, Seely Naval Base, Fort Irwin, Nebo Annex Marine Base, Marine Corp Logistics Base Yermo, Edwards AFB, 29 Palms Marine Base and Camp Pendleton

Workers required to suit up and work in a hazardous material environment: $2.00 per hour additional. Combination mixer

and compressor operator on gunite work shall be classified as a concrete mobile mixer operator.

SEE ZONE DEFINITIONS AFTER CLASSIFICATIONS

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Bargeman; Brakeman; Compressor operator; Ditch Witch, with seat or similar type equipment; Elevator operator-inside; Engineer Oiler; Forklift operator (includes loed, lull or similar types under 5 tons; Generator operator; Generator, pump or compressor plant operator; Pump operator; Signalman; Switchman

GROUP 2: Asphalt-rubber plant operator (nurse tank operator); Concrete mixer operator-skip type; Conveyor operator; Fireman; Forklift operator (includes loed, lull or similar types over 5 tons; Hydrostatic pump operator; oiler crusher (asphalt or concrete plant); Petromat laydown machine; PJU side dum jack; Screening and conveyor machine operator (or similar types); Skiploader (wheel type up to 3/4 yd. without attachment); Tar pot fireman; Temporary heating plant operator; Trenching machine oiler

GROUP 3: Asphalt-rubber blend operator; Bobcat or similar type (Skid steer); Equipment greaser (rack); Ford Ferguson (with dragtype attachments); Helicopter radioman (ground); Stationary pipe wrapping and cleaning machine operator

GROUP 4: Asphalt plant fireman; Backhoe operator (mini-max or similar type); Boring machine operator; Boxman or mixerman (asphalt or concrete); Chip spreading machine operator; Concrete cleaning decontamination machine operator; Concrete Pump Operator (small portable); Drilling machine operator, small auger types (Texoma super economatic or similar types - Hughes 100 or 200 or similar types - drilling depth of 30' maximum); Equipment greaser (grease truck); Guard rail post driver operator; Highline cableway signalman; Hydra-hammer-aero stomper; Micro Tunneling (above ground tunnel); Power concrete curing machine operator; Power concrete saw operator; Power-driven jumbo form setter operator; Power sweeper operator; Rock Wheel Saw/Trencher; Roller operator (compacting); Screed operator (asphalt or concrete); Trenching machine operator (up to 6 ft.); Vacuum or much truck

GROUP 5: Equipment Greaser (Grease Truck/Multi Shift).

GROUP 6: Articulating material hauler; Asphalt plant engineer; Batch plant operator; Bit sharpener; Concrete joint machine operator (canal and similar type); Concrete planer operator; Dandy digger; Deck engine operator; Derrickman (oilfield type); Drilling machine operator, bucket or auger types (Calweld 100 bucket or similar types - Watson 1000 auger or similar types - Texoma 330, 500 or 600 auger or similar types - drilling depth of 45' maximum); Drilling machine operator; Hydrographic seeder machine operator (straw, pulp or seed), Jackson track

maintainer, or similar type; Kalamazoo Switch tamper, or similar type; Machine tool operator; Maginnis internal full slab vibrator, Mechanical berm, curb or gutter(concrete or asphalt); Mechanical finisher operator (concrete, Clary-Johnson-Bidwell or similar); Micro tunnel system (below ground); Pavement breaker operator (truck mounted); Road oil mixing machine operator; Roller operator (asphalt or finish), rubber-tired earth moving equipment (single engine, up to and including 25 yds. struck); Self-propelled tar pipelining machine operator; Skiploader operator (crawler and wheel type, over 3/4 yd. and up to and including 1-1/2 yds.); Slip form pump operator (power driven hydraulic lifting device for concrete forms); Tractor operator-bulldozer, tamper-scraper (single engine, up to 100 h.p. flywheel and similar types, up to and including D-5 and similar types); Tugger hoist operator (1 drum); Ultra high pressure waterjet cutting tool system operator; Vacuum blasting machine operator

GROUP 8: Asphalt or concrete spreading operator (tamping or finishing); Asphalt paving machine operator (Barber Greene or similar type); Asphalt-rubber distribution operator; Backhoe operator (up to and including 3/4 yd.), small ford, Case or similar; Cast-in-place pipe laying machine operator; Combination mixer and compressor operator (gunite work); Compactor operator (self-propelled); Concrete mixer operator (paving); Crushing plant operator; Drill Doctor; Drilling machine operator, Bucket or auger types (Calweld 150 bucket or similar types - Watson 1500, 2000 2500 auger or similar types - Texoma 700, 800 auger or similar types - drilling depth of 60' maximum); Elevating grader operator; Grade checker; Gradall operator; Grouting machine operator; Heavy-duty repairman; Heavy equipment robotics operator; Kalamazoo balliste regulator or similar type; Kolman belt loader and similar type; Le Tourneau blob compactor or similar type; Loader operator (Athey, Euclid, Sierra and similar types); Mobark Chipper or similar; Ozzie padder or similar types; P.C. slot saw; Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pumpcrete gun operator; Rock Drill or similar types; Rotary drill operator (excluding caisson type); Rubber-tired earth-moving equipment operator (single engine, caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator (multiple engine up to and including 25 yds. struck); Rubber-tired scraper operator (self-loading paddle wheel type-John Deere, 1040 and similar single unit); Self-propelled curb and gutter machine operator; Shuttle buggy; Skiploader operator (crawler and wheel type over 1-1/2 yds. up to and including 6-1/2 yds.); Soil remediation plant operator; Surface heaters and planer operator; Tractor compressor drill combination operator; Tractor operator (any type larger than D-5 - 100 flywheel h.p. and over, or similar-bulldozer, tamper, scraper and push tractor single engine); Tractor operator (boom attachments), Traveling pipe wrapping, cleaning and bendng machine operator; Trenching machine operator (over 6 ft. depth capacity,

manufacturer's rating); trenching Machine with Road Miner attachment (over 6 ft depth capacity): Ultra high pressure waterjet cutting tool system mechanic; Water pull (compaction) operator

GROUP 9: Heavy Duty Repairman

GROUP 10: Drilling machine operator, Bucket or auger types (Calweld 200 B bucket or similar types-Watson 3000 or 5000 auger or similar types-Texoma 900 auger or similar types-drilling depth of 105' maximum); Dual drum mixer, dynamic compactor LDC350 (or similar types); Monorail locomotive operator (diesel, gas or electric); Motor patrol-blade operator (single engine); Multiple engine tractor operator (Euclid and similar type-except Quad 9 cat.); Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Pneumatic pipe ramming tool and similar types; Prestressed wrapping machine operator; Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Rubber tired earth moving equipment operator (multiple engine, Euclid, caterpillar and similar over 25 yds. and up to 50 yds. struck), Tower crane repairman; Tractor loader operator (crawler and wheel type over 6-1/2 yds.); Woods mixer operator (and similar Pugmill equipment)

GROUP 11: Heavy Duty Repairman - Welder Combination, Welder - Certified.

GROUP 12: Auto grader operator; Automatic slip form operator; Drilling machine operator, bucket or auger types (Calweld, auger 200 CA or similar types - Watson, auger 6000 or similar types - Hughes Super Duty, auger 200 or similar types - drilling depth of 175' maximum); Hoe ram or similar with compressor; Mass excavator operator less tha 750 cu. yards; Mechanical finishing machine operator; Mobile form traveler operator; Motor patrol operator (multi-engine); Pipe mobile machine operator; Rubber-tired earth- moving equipment operator (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck); Rubber-tired self- loading scraper operator (paddle-wheel-auger type self-loading - two (2) or more units)

GROUP 13: Rubber-tired earth-moving equipment operator operating equipment with push-pull system (single engine, up to and including 25 yds. struck)

GROUP 14: Canal liner operator; Canal trimmer operator; Remote- control earth-moving equipment operator (operating a second piece of equipment: $1.00 per hour additional); Wheel excavator operator (over 750 cu. yds.)

GROUP 15: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple

engine-up to and including 25 yds. struck)

GROUP 16: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 17: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 50 cu. yds. struck); Tandem tractor operator (operating crawler type tractors in tandem - Quad 9 and similar type)

GROUP 18: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, up to and including 25 yds. struck)

GROUP 19: Rotex concrete belt operator (or similar types); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds.and up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, up to and including 25 yds. struck)

GROUP 20: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps, and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 21: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

GROUP 22: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, up to and including 25 yds. struck)

GROUP 23: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating with the tandem push-pull system (multiple engine, up to and including 25

yds. struck)

GROUP 24: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 25: Concrete pump operator-truck mounted; Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

CRANES, PILEDRIVING AND HOISTING EQUIPMENT CLASSIFICATIONS

GROUP 1: Engineer oiler; Fork lift operator (includes loed, lull or similar types)

GROUP 2: Truck crane oiler

GROUP 3: A-frame or winch truck operator; Ross carrier operator (jobsite)

GROUP 4: Bridge-type unloader and turntable operator; Helicopter hoist operator

GROUP 5: Hydraulic boom truck; Stinger crane (Austin-Western or similar type); Tugger hoist operator (1 drum)

GROUP 6: Bridge crane operator; Cretor crane operator; Hoist operator (Chicago boom and similar type); Lift mobile operator; Lift slab machine operator (Vagtborg and similar types); Material hoist and/or manlift operator; Polar gantry crane operator; Self Climbing scaffold (or similar type); Shovel, backhoe, dragline, clamshell operator (over 3/4 yd. and up to 5 cu. yds. mrc); Tugger hoist operator

GROUP 7: Pedestal crane operator; Shovel, backhoe, dragline, clamshell operator (over 5 cu. yds. mrc); Tower crane repair; Tugger hoist operator (3 drum)

GROUP 8: Crane operator (up to and including 25 ton capacity); Crawler transporter operator; Derrick barge operator (up to and including 25 ton capacity); Hoist operator, stiff legs, Guy derrick or similar type (up to and including 25 ton capacity); Shovel, backhoe, dragline, clamshell operator (over 7 cu. yds., M.R.C.)

GROUP 9: Crane operator (over 25 tons and up to and including 50 tons mrc); Derrick barge operator (over 25 tons up to and including 50 tons mrc); Highline cableway operator; Hoist operator, stiff legs, Guy derrick or similar type (over 25 tons up to and including 50 tons mrc); K-crane operator; Polar crane operator; Self erecting tower crane operator maximum lifting capacity ten tons

GROUP 10: Crane operator (over 50 tons and up to and including 100 tons mrc); Derrick barge operator (over 50 tons up to and including 100 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 50 tons up to and including 100 tons mrc), Mobile tower crane operator (over 50 tons, up to and including 100 tons M.R.C.); Tower crane operator and tower gantry

GROUP 11: Crane operator (over 100 tons and up to and including 200 tons mrc); Derrick barge operator (over 100 tons up to and including 200 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 100 tons up to and including 200 tons mrc); Mobile tower crane operator (over 100 tons up to and including 200 tons mrc)

GROUP 12: Crane operator (over 200 tons up to and including 300 tons mrc); Derrick barge operator (over 200 tons up to and including 300 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 200 tons, up to and including 300 tons mrc); Mobile tower crane operator (over 200 tons, up to and including 300 tons mrc)

GROUP 13: Crane operator (over 300 tons); Derrick barge operator (over 300 tons); Helicopter pilot; Hoist operator, stiff legs, Guy derrick or similar type (over 300 tons); Mobile tower crane operator (over 300 tons)

TUNNEL CLASSIFICATIONS

GROUP 1: Skiploader (wheel type up to 3/4 yd. without attachment)

GROUP 2: Power-driven jumbo form setter operator

GROUP 3: Dinkey locomotive or motorperson (up to and including 10 tons)

GROUP 4: Bit sharpener; Equipment greaser (grease truck); Slip form pump operator (power-driven hydraulic lifting device for concrete forms); Tugger hoist operator (1 drum); Tunnel locomotive operator (over 10 and up to and including 30 tons)

GROUP 5: Backhoe operator (up to and including 3/4 yd.); Small Ford, Case or similar; Drill doctor; Grouting machine operator; Heading shield operator; Heavy-duty repairperson; Loader operator (Athey, Euclid, Sierra and similar types); Mucking machine operator (1/4 yd., rubber-tired, rail or track type); Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pneumatic heading shield (tunnel); Pumpcrete gun operator; Tractor compressor drill combination operator; Tugger hoist operator (2 drum); Tunnel locomotive operator (over 30 tons)

GROUP 6: Heavy Duty Repairman

GROUP 7: Tunnel mole boring machine operator

ENGINEERS ZONES

$1.00 additional per hour for all of IMPERIAL County and the portions of KERN, RIVERSIDE & SAN BERNARDINO Counties as defined below:

That area within the following Boundary: Begin in San Bernardino County, approximately 3 miles NE of the intersection of I-15 and the California State line at that point which is the NW corner of Section 1, T17N,m R14E, San Bernardino Meridian. Continue W in a straight line to that point which is the SW corner of the northwest quarter of Section 6, T27S, R42E, Mt. Diablo Meridian. Continue North to the intersection with the Inyo County Boundary at that point which is the NE corner of the western half of the northern quarter of Section 6, T25S, R42E, MDM. Continue W along the Inyo and San Bernardino County boundary until the intersection with Kern County, as that point which is the SE corner of Section 34, T24S, R40E, MDM. Continue W along the Inyo and Kern County boundary until the intersection with Tulare County, at that point which is the SW corner of the SE quarter of Section 32, T24S, R37E, MDM. Continue W along the Kern and Tulare County boundary, until that point which is the NW corner of T25S, R32E, MDM. Continue S following R32E lines to the NW corner of T31S, R32E, MDM. Continue W to the NW corner of T31S, R31E, MDM. Continue S to the SW corner of T32S, R31E, MDM. Continue W to SW corner of SE quarter of Section 34, T32S, R30E, MDM. Continue S to SW corner of T11N, R17W, SBM. Continue E along south boundary of T11N, SBM to SW corner of T11N, R7W, SBM. Continue S to SW corner of T9N, R7W, SBM. Continue E along south boundary of T9N, SBM to SW corner of T9N, R1E, SBM. Continue S along west boundary of R1E, SMB to Riverside County line at the SW corner of T1S, R1E, SBM. Continue E along south boundary of T1s, SBM (Riverside County Line) to SW corner of T1S, R10E, SBM. Continue S along west boundary of R10E, SBM to Imperial County line at the SW corner of T8S, R10E, SBM. Continue W along Imperial and Riverside county line to NW corner of T9S, R9E, SBM. Continue S along the boundary between Imperial and San Diego Counties, along the west edge of R9E, SBM to the south boundary of Imperial County/California state line. Follow the California state line west to Arizona state line, then north to Nevada state line, then continuing NW back to start at the point which is the NW corner of Section 1, T17N, R14E, SBM

$1.00 additional per hour for portions of SAN LUIS OBISPO, KERN, SANTA BARBARA & VENTURA as defined below:

That area within the following Boundary: Begin approximately 5 miles north of the community of Cholame, on the Monterey County and San Luis Obispo County boundary at the NW corner of T25S, R16E, Mt. Diablo Meridian. Continue south along the west side of R16E to the SW corner of T30S, R16E, MDM. Continue E to SW corner of T30S, R17E, MDM. Continue S to SW corner of T31S, R17E, MDM. Continue E to SW corner of T31S, R18E, MDM. Continue S along West side of R18E, MDM as it crosses into San Bernardino Meridian numbering area and becomes R30W. Follow the west side of R30W, SBM to the SW corner of T9N, R30W, SBM.

Continue E along the south edge of T9N, SBM to the Santa Barbara County and Ventura County boundary at that point whch is the SW corner of Section 34.T9N, R24W, SBM, continue S along the Ventura County line to that point which is the SW corner of the SE quarter of Section 32, T7N, R24W, SBM. Continue E along the south edge of T7N, SBM to the SE corner to T7N, R21W, SBM. Continue N along East side of R21W, SBM to Ventura County and Kern County boundary at the NE corner of T8N, R21W. Continue W along the Ventura County and Kern County boundary to the SE corner of T9N, R21W. Continue North along the East edge of R21W, SBM to the NE corner of T12N, R21W, SBM. Continue West along the north edge of T12N, SBM to the SE corner of T32S, R21E, MDM. [T12N SBM is a think strip between T11N SBM and T32S MDM]. Continue North along the East side of R21E, MDM to the Kings County and Kern County border at the NE corner of T25S, R21E, MDM, continue West along the Kings County and Kern County Boundary until the intersection of San Luis Obispo County. Continue west along the Kings County and San Luis Obispo County boundary until the intersection with Monterey County. Continue West along the Monterey County and San Luis Obispo County boundary to the beginning point at the NW corner of T25S, R16E, MDM.

$2.00 additional per hour for INYO and MONO Counties and the Northern portion of SAN BERNARDINO County as defined below:

That area within the following Boundary: Begin at the intersection of the northern boundary of Mono County and the California state line at the point which is the center of Section 17, T10N, R22E, Mt. Diablo Meridian. Continue S then SE along the entire western boundary of Mono County, until it reaches Inyo County at the point which is the NE corner of the Western half of the NW quarter of Section 2, T8S, R29E, MDM. Continue SSE along the entire western boundary of Inyo County, until the intersection with Kern County at the point which is the SW corner of the SE 1/4 of Section 32, T24S, R37E, MDM. Continue E along the Inyo and Kern County boundary until the intersection with San Bernardino County at that point which is the SE corner of section 34, T24S, R40E, MDM. Continue E along the Inyo and San Bernardino County boundary until the point which is the NE corner of the Western half of the NW quarter of Section 6, T25S, R42E, MDM. Continue S to that point which is the SW corner of the NW quarter of Section 6, T27S, R42E, MDM. Continue E in a straight line to the California and Nevada state border at the point which is the NW corner of Section 1, T17N, R14E, San Bernardino Meridian. Then continue NW along the state line to the starting point, which is the center of Section 18, T10N, R22E, MDM.

REMAINING AREA NOT DEFINED ABOVE RECIEVES BASE RATE

ENGI0012-004 08/01/2012

	Rates	Fringes
OPERATOR: Power Equipment		

(DREDGING)

(1) Leverman	$ 45.40	20.00
(2) Dredge dozer	$ 40.93	20.00
(3) Deckmate	$ 40.82	20.00
(4) Winch operator (stern winch on dredge)	$ 40.27	20.00
(5) Fireman-Oiler, Deckhand, Bargeman, Leveehand	$ 39.73	20.00
(6) Barge Mate	$ 40.34	20.00

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* IRON0002-004 01/01/2013

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 26.58	16.74
Ornamental, Reinforcing and Structural	$ 33.00	25.30

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

LABO0089-001 07/01/2012

	Rates	Fringes
LABORER (BUILDING and all other Residential Construction)		
Group 1	$ 27.10	15.17
Group 2	$ 27.56	15.17
Group 3	$ 27.97	15.17
Group 4	$ 28.81	15.17
Group 5	$ 32.93	15.17
LABORER (RESIDENTIAL CONSTRUCTION - See definition below)		
(1) Laborer	$ 23.48	14.13

(2) Cleanup, Landscaping, Fencing (chain link or wood).....$ 22.19 14.13

RESIDENTIAL DEFINITION: Wood or metal frame construction of single family residences, apartments and condominums - excluding (a) projects that exceed three stories over a garage level, (b) any utility work such as telephone, gas, water, sewer and other utilities and (c) any fine grading work, utility work or paving work in the future street and public right-of-way; but including all rough grading work at the job site behind the existing right of way

LABORER CLASSIFICATIONS

GROUP 1: Cleaning and handling of panel forms; Concrete Screeding for Rought Strike-off; Concrete, water curing; Demolition laborer; Flagman; Gas, oil and/or water pipeline laborer; General Laborer; General clean-up laborer; Landscape laborer; Jetting laborer; Temporary water and air lines laborer; Material hoseman (walls, slabs, floors and decks); Plugging, filling of Shee-bolt holes; Dry packing of concrete; Railroad maintenance, Repair Trackman and road beds, Streetcar and railroad construction trac laborers; Slip form raisers; Slurry seal crews (mixer operator, applicator operator, squeegee man, Shuttle man, top man), filling of cracks by any method on any surface; Tarman and mortar man; Tool crib or tool house laborer; Window cleaner; Wire Mesh puling-all concrete pouring operations

GROUP 2: Asphalt Shoveler; Cement Dumper (on 1 yard or larger mixer and handling bulk cement); Cesspool digger and installer; Chucktender; Chute man, pouring concrete, the handling of the cute from ready mix trucks, such as walls, slabs, decks, floors, foundations, footings, curbs, gutters and sidewalks; Concrete curer-impervious membrane and form oiler; Cutting torch operator (demoliton); Guinea chaser; Headboard man-asphlt; Laborer, packing rod steel and pans; membrane vapor barrier installer; Power broom sweepers (small); Riiprap, stonepaver, placing stone or wet sacked concrete; Roto scraper and tiller; Tank sealer and cleaner; Tree climber, faller, chain saw operator, Pittsburgh Chipper and similar type brush shredders; Underground laborers, including caisson bellower

GROUP 3: Buggymobile; Concrete cutting torch; Concrete cutting torch; Concrete pile cutter; Driller, jackhammer, 2 1/2 feet drill steel or longer; Dri Pak-it machine; High sealer (including drilling of same); Hydro seeder and similar type; Impact wrench, mult-plate; Kettlemen, potmen and mean applying asphalt, lay-kold, creosote, line caustic and similar type materials (applying means applying, dipping, brushing or handling of such materials for pipe wrapping and waterproofing); Operators of pneumatic, gas, electric tools, vibratring machines, pavement breakers, air blasting, come-along, and similar mechanical tools not separately classified herein; Pipelayers back up man

coating, grouting, making of joints, sealing, caulking, diapering and inclduing rubber gasket joints, pointing and any and all other services; Rotary Scarifier or multiple head concrete chipping scaarifier; Steel header board man and guideline setter; Tampers, Barko, Wacker and similar type; Trenching machine, handpropelled

GROUP 4: Asphalt raker, luterman, ironer, apshalt dumpman and asphalt spreader boxes (all types); Concrete core cutter (walls, floors or ceilings), Grinder or sander; Concrete saw man; cutting walls or flat work, scoring old or new concrete; Cribber, shorer, lagging, sheeting and trench bracing, hand-guided lagging hammer; Laser beam in connection with laborer's work; Oversize concrete vibrator operator 70 pounds and over; Pipelayer performing all services in the laying, installation and all forms of connection of pipe from the point of receiving pipe in the ditch until completion of oepration, including any and all forms of tubular material, whether pipe, metallic or non-metallic, conduit, and any other stationary type of tubular device used for the conveying of any substance or element, whether water, sewage, solid, gas, air or other product whatsoever and without regard to the nature of material from which the tubular material is fabricated; No joint pipe and stripping of same; Prefabricated manhole installer; Sandblaster (nozzleman), Porta shot-blast, water blasting

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all pwder and explosives of whatever type, regardless of method used for such loading and placing; Driller-all power drills, excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and any and all other types of mechanical drills without regard to the form of motive power.

LABO0089-002 07/01/2010

	Rates	Fringes
LABORER (MASON TENDER).....	$ 27.11	14.38

LABO0089-004 07/01/2012

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
Laborers:		
GROUP 1.....	$ 27.10	15.17
GROUP 2.....	$ 27.56	15.17
GROUP 3.....	$ 27.97	15.17
GROUP 4.....	$ 28.81	15.17
GROUP 5.....	$ 32.93	15.17

LABORER CLASSIFICATIONS

GROUP 1: Laborer: General or Construction Laborer, Landscape

Laborer. Asphalt Rubber Material Loader. Boring Machine Tender (outside), Carpenter Laborer (cleaning, handling, oiling & blowing of panel forms and lumber), Concrete Laborer, Concrete Screeding for rough strike-off, Concrete water curing. Concrete Curb & Gutter laborer, Certified Confined Space Laborer, Demolition laborer & Cleaning of Brick and lumber,Expansion Joint Caulking; Environmental Remediation, Monitoring Well, Toxic waste and Geotechnical Drill tender, Fine Grader, Fire Watcher, Limbers, Brush Loader, Pilers and Debris Handlers. flagman. Gas Oil and Water Pipeline Laborer. Material Hoseman (slabs, walls, floors, decks); Plugging, filling of shee bolt holes; Dry packing of concrete and patching; Post Holer Digger (manual); Railroad maintenance, repair trackman, road beds; Rigging & signaling; Scaler, Slip-Form Raisers, Filling cracks on any surface, tool Crib or Tool House Laborer, Traffic control (signs, barriers, barricades, delineator, cones etc.), Window Cleaner

GROUP 2: Asphalt abatement; Buggymobile; Cement dumper (on 1 yd. or larger mixers and handling bulk cement); Concrete curer, impervious membrane and form oiler; Chute man, pouring concrete; Concrete cutting torch; Concrete pile cutter; driller/Jackhammer, with drill steel 2 1/'2 feet or longer; Dry pak-it machine; Fence erector; Pipeline wrapper, gas, oil, water, pot tender & form man; Grout man; Installation of all asphalt overlay fabric and materials used for reinforcing asphalt; Irrigation laborer; Kettleman-Potman hot mop, includes applying asphalt, lay-klold, creosote, lime caustic and similar tyhpes of materials (dipping, brushing, handling) and waterproofing; Membrane vapor barrier installer; Pipelayer backup man (coating, grouting, making of joints, sealing caulkiing, diapering including rubber basket joints, pointing); Rotary scarifier, multiple head concrete chipper; Rock slinger; Roto scraper & tiller; Sandblaster pot tender; Septic tank digger/installer; Tamper/wacker operator; Tank scaler & cleaner; Tar man & mortar man; Tree climber/faller, chainb saw operator, Pittsburgh chipper & similar type brush shredders.

GROUP 3: Asphalt, installation of all frabrics; Buggy Mobile Man, Bushing hammer; Compactor (all types), Concrete Curer - Impervious membrane, Form Oiler, Concrete Cutting Torch, Concrete Pile Cutter,Driller/Jackhammer with drill steel 2 1/2 ft or longer, Dry Pak-it machine, Fence erector including manual post hole digging, Gas oil or water Pipeline Wrapper - 6 ft pipe and over, Guradrail erector, Hydro seeder, Impact Wrench man (multi plate), kettleman-Potman Hot Mop includes applying Asphalt, Lay-Kold, Creosote, lime caustic and similar types of materials (dipping, brushing or handling) and waterproofing. Laser Beam in connection with Laborer work. High Scaler, Operators of Pneumatic Gas or Electric Tools, Vibrating Machines, Pavement Breakers, Air Blasting, Come-Alongs and similar mechanical tools, Remote-Controlled Robotic Tools in connection with Laborers work. Pipelayer Backup Man (Coating, grouting,m makeing of joints, sealing,

caulking, diapering including rubber gasket joints, pointing and other services). Power Post Hole Digger, Rotary Scarifier (multiple head concrete chipper scarifier), Rock Slinger, Shot Blast equipment (8 to 48 inches), Steel Headerboard Man and Guideline Setter, Tamper/Wacker operator and similar types, Trenching Machine hand propelled.

GROUP 4: Any worker exposed to raw sewage. Asphalt Raker, Luteman, Asphalt Dumpman, Asphalt Spreader Boxes, Concrete Core Cutter, Concrete Saw Man, Cribber, Shorer, Head Rock Slinger. Installation of subsurface instrumentation, monitoring wells or points, remediation system installer; Laborer, asphalt-rubber distributor bootman; Oversize concrete vibrator operators, 70 pounds or over. Pipelayer, Prfefabricated Manhole Installer, Sandblast Nozzleman (Water Balsting-Porta Shot Blast), Traffic Lane Closure.

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all powder and explosives of whatever type, regardless of method used for such loading and placing; Horizontal directional driller, Boring system, Electronic traking, Driller: all power drills excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and all other types of mechanical drills without regard to form of motive power. Environmental remediation, Monitoring well, Toxic waste and Geotechnical driller, Toxic waste removal. Welding in connection with Laborer's work.

LABO0300-008 08/05/2009

	Rates	Fringes
LABORER		
PLASTER CLEAN-UP LABORER	$ 26.65	15.95
PLASTER TENDER	$ 29.20	15.95

Work at Military Bases - $3.00 additional per hour:
Coronado Naval Amphibious Base, Fort Irwin, Marine Corps Air Station-29 Palms, Imperial Beach Naval Air Station, Marine Corps Logistics Supply Base, Marine Corps Pickle Meadows, Mountain Warfare Training Center, Naval Air Facility-Seeley, North Island Naval Air Station, Vandenberg AFB.

LABO0882-002 01/01/2010

	Rates	Fringes
Asbestos Removal Laborer	$ 26.15	11.65

SCOPE OF WORK: Includes site mobilization, initial site cleanup, site preparation, removal of asbestos-containing material and toxic waste, encapsulation, enclosure and disposal of asbestos- containing materials and toxic waste by hand or with equipment or machinery; scaffolding, fabrication of temporary wooden barriers and assembly of

decontamination stations.

LABO1184-001 08/01/2012

	Rates	Fringes
Laborers: (HORIZONTAL DIRECTIONAL DRILLING)		
(1) Drilling Crew Laborer...	$ 29.01	11.68
(2) Vehicle Operator/Hauler.	$ 29.18	11.68
(3) Horizontal Directional Drill Operator.....	$ 31.03	11.68
(4) Electronic Tracking Locator.....	$ 33.03	11.68
Laborers: (STRIPING/SLURRY SEAL)		
GROUP 1.....	$ 29.96	14.38
GROUP 2.....	$ 31.26	14.38
GROUP 3.....	$ 33.27	14.38
GROUP 4.....	$ 35.01	14.38

LABORERS - STRIPING CLASSIFICATIONS

GROUP 1: Protective coating, pavement sealing, including repair and filling of cracks by any method on any surface in parking lots, game courts and playgrounds; carstops; operation of all related machinery and equipment; equipment repair technician

GROUP 2: Traffic surface abrasive blaster; pot tender - removal of all traffic lines and markings by any method (sandblasting, waterblasting, grinding, etc.) and preparation of surface for coatings. Traffic control person: controlling and directing traffic through both conventional and moving lane closures; operation of all related machinery and equipment

GROUP 3: Traffic delineating device applicator: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices including traffic control. This category includes all traffic related surface preparation (sandblasting, waterblasting, grinding) as part of the application process. Traffic protective delineating system installer: removes, relocates, installs, permanently affixed roadside and parking delineation barricades, fencing, cable anchor, guard rail, reference signs, monument markers; operation of all related machinery and equipment; power broom sweeper

GROUP 4: Striper: layout and application of traffic stripes and markings; hot thermo plastic; tape traffic stripes and markings, including traffic control; operation of all related machinery and equipment

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PAIN0036-001 01/01/2012

	Rates	Fringes

Painters: (Including Lead Abatement)

(1) Repaint (excludes San Diego County)	$ 26.05	10.35
(2) All Other Work	$ 29.32	10.35

REPAINT of any previously painted structure. Exceptions: work involving the aerospace industry, breweries, commercial recreational facilities, hotels which operate commercial establishments as part of hotel service, and sports facilities.

PAIN0036-010 10/01/2012

	Rates	Fringes
DRYWALL FINISHER/TAPER		
(1) Building & Heavy Construction	$ 25.08	12.69
(2) Residential Construction (Wood frame apartments, single family homes and multi-duplexes up to and including four stories)	$ 21.00	12.06

PAIN0036-012 10/01/2012

	Rates	Fringes
GLAZIER	$ 38.80	16.25

PAIN0036-019 02/01/2009

	Rates	Fringes
SOFT FLOOR LAYER	$ 26.77	11.75

PLAS0200-005 08/01/2011

	Rates	Fringes
PLASTERER	$ 35.29	12.05

NORTH ISLAND NAVAL AIR STATION, COLORADO NAVAL AMPHIBIOUS BASE, IMPERIAL BEACH NAVAL AIR STATION: $3.00 additional per hour.

PLAS0500-001 07/01/2012

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER		
GROUP 1	$ 26.47	12.10
GROUP 2	$ 28.12	12.10
GROUP 3	$ 30.75	12.60

CEMENT MASONS - work inside the building line, meeting the

following criteria:

GROUP 1: Residential wood frame project of any size; work classified as Type III, IV or Type V construction; interior tenant improvement work regardless the size of the project; any wood frame project of four stories or less.

GROUP 2: Work classified as type I and II construction

GROUP 3: All other work

PLUM0016-006 07/01/2012

	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER		
Camp Pendleton	$ 46.10	19.68
Plumber and Pipefitter All other work except work on new additions and remodeling of bars, restaurant, stores and commercial buildings not to exceed 5,000 sq. ft. of floor space and work on strip malls, light commercial, tenant improvement and remodel work	$ 41.60	19.68
Work ONLY on new additions and remodeling of commercial buildings, bars, restaurants, and stores not to exceed 5,000 sq. ft. of floor space	$ 40.33	18.70
Work ONLY on strip malls, light commercial, tenant improvement and remodel work	$ 32.49	17.03

PLUM0016-011 07/01/2012

	Rates	Fringes
PLUMBER/PIPEFITTER		
Residential	$ 33.63	15.60

PLUM0345-001 07/01/2012

	Rates	Fringes
PLUMBER		
Landscape/Irrigation Fitter	$ 27.35	17.09
Sewer & Storm Drain Work	$ 31.00	16.01

ROOF0045-001 07/01/2012

	Rates	Fringes
ROOFER	$ 25.08	7.28

SFCA0669-001 04/01/2012

	Rates	Fringes
SPRINKLER FITTER	$ 34.18	18.51

SHEE0206-001 01/01/2012

	Rates	Fringes
SHEET METAL WORKER		
Camp Pendleton	$ 35.05	19.23
Except Camp Pendleton	$ 33.05	19.23
Sheet Metal Technician	$ 25.22	6.69

SHEET METAL TECHNICIAN - SCOPE:
a. Existing residential buildings, both single and multi-family, where each unit is heated and/or cooled by a separate system b. New single family residential buildings including tracts. c. New multi-family residential buildings, not exceeding five stories of living space in height, provided each unit is heated or cooled by a separate system. Hotels and motels are excluded. d. LIGHT COMMERCIAL WORK: Any sheet metal, heating and air conditioning work performed on a project where the total construction cost, excluding land, is under $1,000,000 e. TENANT IMPROVEMENT WORK: Any work necessary to finish interior spaces to conform to the occupants of commercial buildings, after completion of the building shell

TEAM0036-001 07/01/2012

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 15.40	20.50
GROUP 2	$ 24.99	20.50
GROUP 3	$ 25.19	20.50
GROUP 4	$ 25.39	20.50
GROUP 5	$ 25.59	20.50
GROUP 6	$ 26.09	20.50
GROUP 7	$ 27.59	20.50

FOOTNOTE: HAZMAT PAY: Work on a hazmat job, where hazmat certification is required, shall be paid, in addition to the classification working in, as follows: Levels A, B and C - +$1.00 per hour. Workers shall be paid hazmat pay in increments of four (4) and eight (8) hours.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Fuel Man, Swamper

GROUP 2: 2-axle Dump Truck, 2-axle Flat Bed,Concrete Pumping

Truck, Industrial Lift Truck, Motorized Traffic Control, Pickup Truck on Jobsite

GROUP 3: 2-axle Water Truck, 3-axle Dump Truck, 3-axle Flat Bed, Erosion Control Nozzleman, Dump Crete Truck under 6.5 yd, Forklift 15,000 lbs and over, Prell Truck, Pipeline Work Truck Driver, Road Oil Spreader, Cement Distributor or Slurry Driver, Bootman, Ross Carrier

GROUP 4: Off-road Dump Truck under 35 tons 4-axles but less than 7-axles, Low-Bed Truck & Trailer, Transit Mix Trucks under 8 yd, 3-axle Water Truck, Erosion Control Driver, Grout Mixer Truck, Dump Crete 6.5yd and over, Dumpster Trucks, DW 10, DW 20 and over, Fuel Truck and Dynamite, Truck Greaser, Truck Mounted Mobile Sweeper 2-axle Winch Truck

GROUP 5: Off-road Dump Truck 35 tons and over, 7-axles or more, Transit Mix Trucks 8 yd and over, A-Frame Truck, Swedish Cranes

GROUP 6: Off-Road Special Equipment (including but not limited to Water Pull Tankers, Athey Wagons, DJB, B70 Wuclids or like Equipment)

GROUP 7: Repairman

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is

an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rates.

0000/9999: weighted union wage rates will be published annually each January.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION

DESIGN-BUILD AGREEMENT

This Phased-Funded Design-Build agreement [Contract] is made and entered into this ____ day of _____, ____ by and between The City of San Diego [City], a municipal corporation, and **INSERT NAME OF DB FIRM** [Design-Builder], for the purpose of designing and constructing the **MBC Dewatering Centrifuges Replacement Design-Build Contract** (Project) in the amount of _____ ($ _____). The City and Design-Builder are referred to herein as the "Parties".

RECITALS

A. The City desires to construct the Project located in the City of San Diego, California.

B. The City desires to contract with a single entity for design and construction of the Project, as set forth in this Agreement.

C. The City has issued a Request for Proposals [RFP] for **K-13-5573-DB2-3**, pursuant to which the City solicited Proposals from design-build teams to design, rehabilitate, and build the Project.

D. In accordance with City's RFP, Design-Builder submitted a Proposal for the Project and is prepared to enter into this Agreement.

E. The City has selected the Design-Builder to perform, either directly or pursuant to Subcontracts, hereinafter defined, the design, engineering, and construction services set forth in this Agreement and the Contract Documents, hereinafter defined.

F. The Design-Builder is ready, willing, and able to perform the services required in accordance with the terms and conditions of this Agreement.

G. The City is only obligated to issue and pay for Phase I. The Design-Builder will be notified if the City has sufficient funds for Phases II and III and whether those phases will be awarded. There is no legal obligation to issue Phases II and III.

In consideration of the above recitals and the mutual covenants and conditions set forth herein, and for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby set forth their mutual covenants and understandings as follows.

AGREEMENT

A. Recitals and Attachments. The above referenced recitals are true and correct and are incorporated into this Agreement by this reference. All attachments referenced in this Agreement section are incorporated into the Contract by this reference.

B. Contract Performance. The Design-Builder shall design and construct the Project in a good and workmanlike manner to the satisfaction of the City, lien free and in compliance with the Contract Documents and within the time specified, in return for timely payment by the City in accordance with the Contract.

C. Exhibits. All exhibits e.g., Reference Standards in the RFP, Supplementary Special Provisions (SSP), the attached Faithful Performance and Payment Bonds, Agreement and Supplemental Agreements, and the attached Proposal included in the Proposal documents by the Contractor are incorporated into the Contract by this reference.

D. Phase Funding. This Project is funded in phases, and only Phase I is fully funded at this time. The attached Phase Funded Schedule dated _____, is hereby incorporated in to the Contract Documents by reference, with only Phase I being currently funded. The Design-Builder shall not commence any work beyond Phase I work until the City notifies the Design- Builder that funds are available for **the subsequent Phase** and issues an NTP for **that subsequent Phase.**

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Resolution No. R - _____ or Municipal Code _____authorizing such execution.

THE CITY OF SAN DIEGO

By_____

Print Name: _____

Mayor or designee

Date:_____

APPROVED AS TO FORM AND LEGALITY

Jan I. Goldsmith, City Attorney

By_____

Print Name:_____

Deputy City Attorney

Date:_____

CONTRACTOR

By_____

Print Name:_____

Title:_____

Date:_____

City of San Diego License No.:_____

State Contractor's License No.:_____

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

_____, a corporation, as principal, and _____, 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 _____ for the faithful performance of **Phase I of** the annexed contract, and in the sum of _____ for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform **Phase I of** the annexed contract **MBC Dewatering Centrifuges Replacement Design - Build Contract**, Bid Number: **K-13-5573-DB2-3**, 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 **Phase I 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 Chapter 3 of Division 5 of Title I of the Government Code of the State of California or under the provisions of Section 3082 et seq. 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.

City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

ADDENDUM "4"

REQUEST FOR PROPSAL (RFP)

For

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

RFP#	5573
BID NO.	K-13~~2~~-5573-DB2-3
WBS NO.	S-00339
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	7
PROJECT TYPE:	BO

PROPOSAL DUE:

12:00 NOON
FEBRARY 26th, 2013
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1200 THIRD AVENUE, SUITE 200, MS 56P
SAN DIEGO, CA 92101
ATTN: CONTRACT SPECIALIST

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the RFP 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. ADDENDUM 2

1. To Part C, Questions and Answers, A19, page 5 of 13, **DELETE** in its entirety and **SUBSTITUTE** with the following:

   A19. The City agrees to pay the contractor in accordance with the payment terms of Alfa Laval Scope of Supply dated February 14, 2013. Refer to item C 1, Changes to the Request for Proposal, of this Addendum.

C. CHANGES TO THE REQUEST FOR PROPOSAL

1. To the RFP, ATTACHMENT A-1, Alfa Laval Scope of Supply, pages 332 through 336, **DELETE** in their entirety and **SUBSTITUTE** with pages 3 of 7 through 7 of 7 of this Addendum.

Tony Heinrichs, Director
Public Works Department

Dated: February 20, 2013
San Diego, California

TH/nb/egz/lji

ATTACHMENT A-1

ALFA LAVAL SCOPE OF SUPPLY

February 14, 2013

To: Idalmiro DaRosa, Project Manager
City of San Diego
600 B St, Suite 8, San Diego, CA 92101
E-mail: IMdaRosa@sandiego.gov

Alfa Laval Inc.
5400 International Trade Drive
Richmond, VA 23231
Tel: 804-236-1352
Fax: 804-545-2030
sandip.chatterjee@alfalaval.com

Subject: MBC Dewatering Centrifuges Replacement Project, San Diego, CA
Firm Budget Proposal: Alfa Laval Dewatering Centrifuges

To Whom It May Concern:

Alfa Laval is pleased to offer this firm budget proposal for the **Alfa Laval Centrifuges** on this project. We are using the term "firm budget proposal", as the details of the final specification and scope of supply have yet to be determined.

Based on the current specification details and notations listed in our Notes of Clarification below, **Six (6) ALDEC G2-120 Centrifuges** for dewatering of the sludge will be complete and each will include the following:

- Modular Frame with Upper Casing Cover
- Upper casing (316 SS) and Lower casing (316 SS cladded)
- Rotating Assembly including Pillow Block Bearings and 30 kNm DD Gearbox
- Grease Lubricated Conveyor Bearings
- Forced Oil Lubricated Main Bearings
- 50 Hp AC VFD Premium Efficiency Back Drive motor
- 200 Hp AC VFD Premium Efficiency Main Drive motor
- NEMA 12 (**Painted Steel – 10 gauge**) Free-standing Centrifuge Control Panel
- ABB Variable Frequency Drives (ACS 800)
- Allen Bradley CompactLogix PLC
- Allen Bradley PanelView PLUS 6 HMI
- Abrasion protection with Tungsten Carbide on wear surfaces
- Power Plates
- Vibration Isolators
- Bearing Vibration Sensors
- Bearing Temperature Sensors
- Factory Paint System
- Forced Oil Lubrication Recirculation System

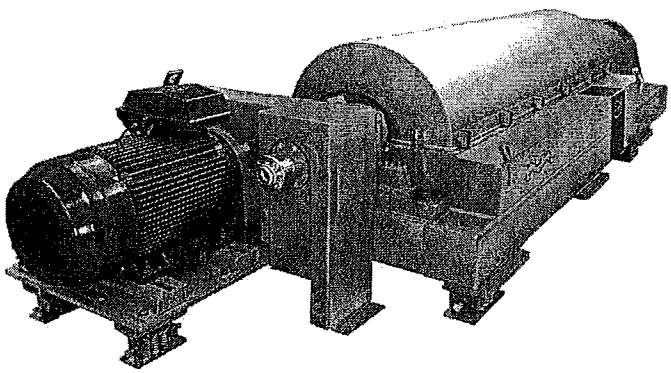
- Flexible connectors – Feed, polymer, centrate & solids
- Solids Outlet Chute (304 SS)
- Transition Centrate Funnel (304 SS)
- Centrifuge Sub base with mounting plates (Painted Steel)
- Warranty against defects in materials and workmanship for 8,760 hours or two (2) years from beneficial use, whichever occurs first
- One (1) set of required spares including o-rings & drive belts
- Thirty (30) spare tungsten carbide tiles
- One (1) set of Solids discharge port replaceable tungsten-carbide wear plates
- One (1) set of vibration and temperature sensors
- One (1) set of fasteners for inspection port, case cover and weir plates
- One (1) set of required lubricants for start-up
- Freight to job-site, DDP

Also included with pricing:

- Service Time – Ninety (90) days on-site for start-up assistance, training and testing
- Submittals w/ Drawings
- Operation and Maintenance Manuals
- One (1) set required tools for maintenance
- One (1) set of Special Tools including bowl lifter and conveyor lifter
- Standard Factory testing of centrifuges at Soborg Factory

Not included in pricing:

- Field wiring and motor flexible connections
- Piping, pipe venting, valves, meters and flow meters
- Owner's expenses for witnessing FAT
- Bowl Truck
- Feed pump
- Grinder/Macerator
- Polymer System & Polymer
- Unloading at job-site
- Anchor Bolts
- Storage and Handling Charges
- Laboratory Testing Charges
- Installation
- Taxes & Bonds



FIRM BUDGET PRICE FOR SIX (6) ALDEC G2-120 CENTRIFUGES: $_____

PRICE VALIDITY: July 31st, 2014 per Notes of Clarifications below.

DELIVERY: Submittals: Estimated 10 – 12 weeks from Receipt of Purchase Order
Centrifuge: Estimated 30 weeks from Receipt of Approved Submittals

PAYMENT TERMS:
20% with Purchase Order
15% upon Submittals, NET 30 Days
45% upon Equipment Delivery, NET 30 Days
20% upon Final Acceptance, NET 30 Days

NOTES OF CLARIFICATION:

1. Because final specifications and scope details are yet to be determined, this proposal is therefore a "firm budget proposal" and an order cannot be accepted based upon it without first receiving a final firm proposal.

2. Price validity is based on receipt of a purchase order for the first four (4) machines on or before July 31, 2013 and receipt of a purchase order for the remaining two (2) machines on or before July 31, 2014.

3. Alfa Laval has reviewed only Sections 11397, 13300 and 13400 while preparing this proposal. Other sections referred to in these sections were not available to Alfa Laval during preparation of this proposal.

4. Alfa Laval has proposed 10 gauge painted steel NEMA 12 Control Panels.

5. Warranty covers defects in materials and workmanship for 8,760 hours or twenty-four (24) months from beneficial use or for a period not to exceed thirty (30) months from shipment, whichever occurs first. Alfa Laval reserves the right to review operating and maintenance records to ensure compliance.

6. Included are service days to meet the specification requirement with the contract price. Any additional service time resulting from non-warranty delays will be charged in accordance with the field service rate schedule in effect at the time of service.

7. The process performance (cake solids, capture, polymer dosage, solids loading, hydraulic throughput, etc.) achieved by the centrifuge is dependant on sludge quality (age, grit content, etc.) and volatile solids content.

8. Alfa Laval will provide anchor bolt sizing. Anchor bolts are to be provided and installed by the installing contractor.

9. Installing contractor is responsible for maintaining all relevant electrical codes.

10. Anything not explicitly stated in this proposal is not included.

If you have any questions or require any additional information, please contact our Regional Manager, Rob Islander at (714) 287 – 0267 or our local representative, Jeremy Neill with The Coombs Hopkins Company at (760) 931 - 0555.

Sincerely,

Lola Guerra
Sales Application Specialist
Environmental Market Unit
lola.guerra@alfalaval.com

Cc: Rob Islander, AL
Steve Johnson, AL
Jeremy Neill, CHC

City of San Diego

CITY CONTACT: DAMIAN SINGLETON, CONTRACT SPECIALIST, Email: dsingleton@sandiego.gov
Phone: (619) 533-3482; Fax: (619) 533-3633

ADDENDUM "4"

REQUEST FOR PROPSAL (RFP)

For

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

RFP#	5573
BID NO.	K-12-5573-DB2-3
WBS NO.	S-00339
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	7
PROJECT TYPE:	BO

PROPOSAL DUE:

12:00 NOON
FEBRARY 26th, 2013
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTING GROUP
1200 THIRD AVENUE, SUITE 200, MS 56P
SAN DIEGO, CA 92101
ATTN: CONTRACT SPECIALIST

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the RFP 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. ADDENDUM 2

1. To Part C, Questions and Answers, A19, page 5 of 13, **DELETE** in its entirety and **SUBSTITUTE** with the following:

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1. To the RFP, ATTACHMENT A-1, Alfa Laval Scope of Supply, pages 332 through 336, **DELETE** in their entirety and **SUBSTITUTE** with pages 3 of 7 through 7 of 7 of this Addendum.

Tony Heinrichs, Director
Public Works Department

Dated: February 20, 2013
San Diego, California

TH/bd/rir/lji

ATTACHMENT A-1

ALFA LAVAL SCOPE OF SUPPLY

February 14, 2013

To: Idalmiro DaRosa, Project Manager
City of San Diego
600 B St, Suite 8, San Diego, CA 92101
E-mail: IMdaRosa@sandiego.gov

Alfa Laval Inc.
5400 International Trade Drive
Richmond, VA 23231
Tel: 804-236-1352
Fax: 804-545-2030
sandip.chatterjee@alfalaval.com

Subject: MBC Dewatering Centrifuges Replacement Project, San Diego, CA
Firm Budget Proposal: Alfa Laval Dewatering Centrifuges

To Whom It May Concern:

Alfa Laval is pleased to offer this firm budget proposal for the **Alfa Laval Centrifuges** on this project. We are using the term "firm budget proposal", as the details of the final specification and scope of supply have yet to be determined.

Based on the current specification details and notations listed in our Notes of Clarification below, **Six (6) ALDEC G2-120 Centrifuges** for dewatering of the sludge will be complete and each will include the following:

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- Grease Lubricated Conveyor Bearings
- Forced Oil Lubricated Main Bearings
- 50 Hp AC VFD Premium Efficiency Back Drive motor
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- NEMA 12 (**Painted Steel – 10 gauge**) Free-standing Centrifuge Control Panel
- ABB Variable Frequency Drives (ACS 800)
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- Abrasion protection with Tungsten Carbide on wear surfaces
- Power Plates
- Vibration Isolators
- Bearing Vibration Sensors
- Bearing Temperature Sensors
- Factory Paint System
- Forced Oil Lubrication Recirculation System

- Flexible connectors – Feed, polymer, centrate & solids
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- Warranty against defects in materials and workmanship for 8,760 hours or two (2) years from beneficial use, whichever occurs first
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- One (1) set of fasteners for inspection port, case cover and weir plates
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- Freight to job-site, DDP

Also included with pricing:

- Service Time – Ninety (90) days on-site for start-up assistance, training and testing
- Submittals w/ Drawings
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- Standard Factory testing of centrifuges at Soborg Factory

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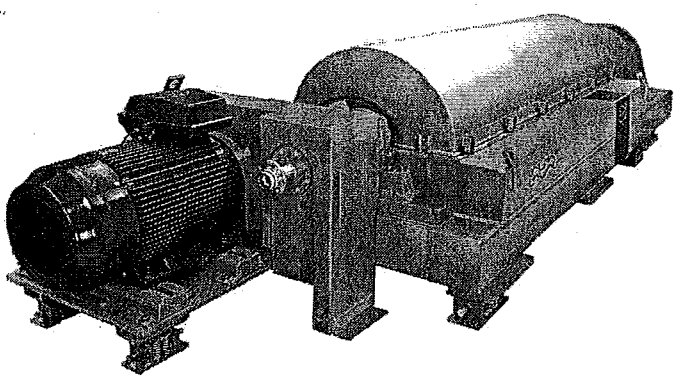
- Grinder/Macerator
- Polymer System & Polymer
- Unloading at job-site
- Anchor Bolts
- Storage and Handling Charges
- Laboratory Testing Charges
- Installation
- Taxes & Bonds



FIRM BUDGET PRICE FOR SIX (6) ALDEC G2-120 CENTRIFUGES: $_____

PRICE VALIDITY: July 31st, 2014 per Notes of Clarifications below.

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45% upon Equipment Delivery, NET 30 Days
20% upon Final Acceptance, NET 30 Days

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7. The process performance (cake solids, capture, polymer dosage, solids loading, hydraulic throughput, etc.) achieved by the centrifuge is dependant on sludge quality (age, grit content, etc.) and volatile solids content.

8. Alfa Laval will provide anchor bolt sizing. Anchor bolts are to be provided and installed by the installing contractor.

9. Installing contractor is responsible for maintaining all relevant electrical codes.

10. Anything not explicitly stated in this proposal is not included.

If you have any questions or require any additional information, please contact our Regional Manager, Rob Islander at (714) 287 – 0267 or our local representative, Jeremy Neill with The Coombs Hopkins Company at (760) 931 - 0555.

Sincerely,

Lola Guerra
Sales Application Specialist
Environmental Market Unit
lola.guerra@alfalaval.com

Cc: Rob Islander, AL
Steve Johnson, AL
Jeremy Neill, CHC

619 533 3450

Purchasing and Contracting Department
Contracting Division
1200 Third Avenue, Suite 200
San Diego, CA 92101
(619) 236-6000

THE CITY OF SAN DIEGO

FAX TRANSMITTAL

Date: March 28, 2013

The following pages are intended for:

To:	**Estimator**	**From:**	**Toni Thompson**
Company:	**Filanc**	**Division:**	**Contracting Division**
FAX #	**760-941-3969**	**FAX #**	**619-533-3633**
Phone #	**760-941-7130**	**Phone #**	**619-533-3435**

RE: Bid # K-13-5573-DB2-3 MBC Dewatering Centrifuges Replacement Design-Build Contract

COMMENTS: In tabulating the bid results of subject project, we have found that the ESTIMATED TOTAL BASE BID is **$9373953.96 NOT $9373954.00** as per your bid. Please FAX acknowledgement/concurrence of the correct amount, by 12:00pm noon today.

If there are any problems with receiving this FAX transmission (such as missing pages), please contact the Sender at the "From" phone number given above.

THIS MESSAGE IS INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED, AND MAY CONTAIN INFORMATION THAT IS PRIVILEGED, CONFIDENTIAL AND EXEMPT FROM DISCLOSURE UNDER APPLICABLE LAW, RECEIPT BY AN UNINTENDED RECIPIENT DOES NOT CONSTITUTE A WAIVER OF ANY APPLICABLE PRIVILEGE.

If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone, and return the original message to us at the above address via the U.S. Postal Service.

3/28/2013 11:34 FAX
3/28/2013/THU 09:37 AM
FAX No.
FILANC CONSTRUCTION
P.002
003/003

PRICE PROPOSAL FORMS

The Bidder agrees to the design and construction of **MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT**, 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.

Item No.	NAICS CODE	Description	Quantity	D*	Unit	Unit Price	Extension
1	237110	Bonds (Payment and Performance)	1		LS		$ 96,985
2	541330	Engineering, Design, & Construction Support Services	1	D	LS		$ 707,316
3	237110	Mobilization	1		LS		$ 114,785
4	237110	Removal of Equipment	1		LS		$ 108,165
5	237110	Dewatering Centrifuges	6		EA	$1,060,726.16	~~$6,364,357~~ 6364356.96
6	237110	Supporting Equipment	6		EA	$ 5,875	$ 35,250
7	238220	Mechanical	1		LS		$ 360,304
8	238210	Electrical	1		LS		$ 773,551
9	237110	Instrumentation	1		LS		$ 328,241
10	237110	City Contingency	1		AL		$425,000.00
		TOTAL FOR PROPOSAL (ITEM NO 1 THROUGH 10 INCLUSIVE):					~~$9,373,954~~ 9373953.96

*** Design Element (For City Use)**

Total Price For Design-Build Proposal, (items 1 through 10, inclusive) amount written in words:

NINE MILLION THREE HUNDRED SEVENTY THREE THOUSAND NINE HUNDRED FIFTY FOUR DOLLARS

I ACKNOWLEDGE THAT THE TOTAL VERBIAGE BID AMOUNT IS $9,373,953.96

DAVID W. KLESS
VICE PRESIDENT
3/28/2013

City of San Diego

CONTRACTOR'S NAME: J.R. Filanc Construction Company, Inc.
ADDRESS: 740 N. Andreasen Dr., Escondido, CA 92029
TELEPHONE NO.: 760-941-7130 FAX NO.: 760-941-3969

CONTRACT DOCUMENTS

FOR

MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT

VOLUME 2 OF 2

BID NO.:	**K-13-5573-DB2-3**
SAP NO. (WBS/IO/CC):	**S-00339**
CLIENT DEPARTMENT:	**2011**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BO**

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- PHASED FUNDING
- FEDERAL EQUAL OPPORTUNITY CONTRACTING REQUIREMENTS.
- PREVAILING WAGE RATES: **STATE, FEDERAL OR BOTH**
- THIS IS A CLEAN WATER STATE REVOLVING FUND CONTRACT THROUGH THE STATE OF CALIFORNIA.

THIS PROPOSAL DOCUMENT TO BE SUBMITTED IN ITS ENTIRETY

Volume 2 - Proposal Documents

The following forms must be completed in their entirety and submitted with the Bid. Include the form(s) even if the information does not apply. Where the information does not apply write in N/A. Failure to include any of the forms may cause the Bid to be deemed **non-responsive.** If you are uncertain or have any questions about any required information, contact the City no later than 14 days prior to Bid due date.

PROPOSAL

Bidder's General Information

To the City of San Diego:

Pursuant to "Invitation to 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 Proposal Documents therefore, and that by submitting said Proposal 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 Proposal Documents.

IF A SOLE OWNER OR SOLE CONTRACTOR SIGN HERE: N/A

(1) Name under which business is conducted_____

(2) Signature (Given and surname) of proprietor _____

(3) Place of Business (Street & Number) _____

(4) City and State _____ Zip Code _____

(5) Telephone No. _____ Facsimile No. _____

IF A PARTNERSHIP, SIGN HERE: N/A

(1) Name under which business is conducted _____

(2) Name of each member of partnership [indicate character of each partner, general or special (limited):

_____

_____

(3) Signature (Note: Signature must be made by a general partner)

_____

Full Name and Character of partner

_____

_____

(4) Place of Business (Street & Number) _____
(5) City and State _____ Zip Code _____
(6) Telephone No. _____ Facsimile No. _____

IF A CORPORATION, SIGN HERE:

(1) Name under which business is conducted J.R. Filanc Construction Company, Inc.

(2) Signature, with official title of officer authorized to sign for the corporation:

_____
(Signature)

David J. Kiess
(Printed Name)

Vice President
(Title of Officer)

(Impress Corporate Seal Here)

(3) Incorporated under the laws of the State of California
(4) Place of Business (Street & Number) 740 N. Andreasen Dr.
(5) City and State Escondido, CA Zip Code 92029
(6) Telephone No. 760-941-7130 Facsimile No. 760-941-3969

THE FOLLOWING SECTIONS MUST BE FILLED IN BY ALL PROPOSERS:

In accordance with the "**INVITATION TO BIDS**", the bidder holds a California State Contractor's license for the following classification(s) to perform the work described in these specifications:

LICENSE CLASSIFICATION Class: A, B, C10, HAZ, ASB

LICENSE NO. 134877 EXPIRES 9/30, 2013

This license classification must also be shown on the front of the bid envelope. Failure to show license classification on the bid envelope may cause return of the bid unopened.

TAX IDENTIFICATION NUMBER (TIN): [redacted]

E-Mail Address: dkiess@filanc.com

THIS PROPOSAL MUST BE NOTARIZED BELOW:

I certify, under penalty of perjury, that the representations made herein regarding my State Contractor's license number, classification and expiration date are true and correct.

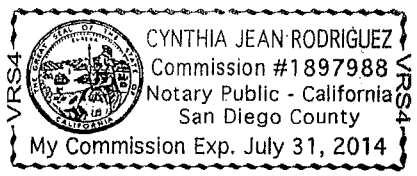
Signature _____ Title Vice President

SUBSCRIBED AND SWORN TO BEFORE ME, THIS 25th DAY OF Feb., 2013.

Notary Public in and for the County of San Diego, State of California

Cynthia Jean Rodriguez

(NOTARIAL SEAL)



NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID UNDER 23 USC 112 AND PCC 7106

State of California)
) ss.
County of San Diego)

David J. Kiess, being first duly sworn, deposes and says that he or she is Vice President of 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.

Signed: David J. Kiess

Title: Vice President

Subscribed and sworn to before me this 25th day of Feb., 2013

Cynthia Jean Rodriguez
Notary Public

CYNTHIA JEAN RODRIGUEZ
Commission #1897988
Notary Public - California
San Diego County
My Commission Exp. July 31, 2014

(SEAL)

CONTRACTORS 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 ten 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.

X 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 ten 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:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Contractor Name J.R. Filanc Construction Company, Inc.

Certified By David J. Kiess Title Vice President

Name

Signature Date 2/25/2013

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: J.R. Filanc Construction Company, Inc.	Contact Name: David J. Kiess
Company Address: 740 N. Andreasen Drive	Contact Phone: 760-941-7130
Escondido, CA 92029	Contact Email: dkiess@filanc.com

CONTRACT INFORMATION

Contract Title: MBC Dewatering Centrifuges Replacement Design-Build Contract	Start Date:
Contract Number (if no number, state location): K-13-5573-DB2-3	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.

David J. Kiess, Vice President
Name/Title of Signatory

Signature

FOR OFFICIAL CITY USE ONLY

Receipt Date: EBO Analyst: ☐ Approved ☐ Not Approved – Reason:

rev 02/15/2011

LOBBY PROHIBITION, CERTIFICATION AND DISCLOSURE

In acknowledgment that funds received under this agreement have been provided pursuant to a Federal grant, recipient hereby recognizes the prohibitions against lobbying the Federal government with any of these funds. Recipient agrees that it shall comply with the laws set forth at 31 U.S.C. § 1352 (1989) and 24 C.F.R. part 87, to wit:

A. Conditions on use of funds

Recipient shall not expend any funds received pursuant to this agreement to pay any person to influence an officer or employee of Federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with any of the following Covered Federal actions:

(1) The awarding of any federal contract
(2) The making of any Federal grant
(3) The making of any Federal Loan
(4) The entering into of any cooperative agreement
(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

For purposes of defining the terms of this part of the agreement, the definitions set forth in 24 C.F.R. § 87.105 are hereby adopted and incorporated herein by reference.

B. Certification and Disclosure

Each recipient at every tier under this agreement shall file a certification regarding lobbying, and a Disclosure Form-LLL, where required by 24 C.F.R. § 87.110. The certification form and Disclosure Form-LLL are attached to this agreement.

C. Certifications must be filed:

(1) By any person upon each submission that initiates agency consideration for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000, or a Federal loan or loan guarantee exceeding $150,000.
(2) Upon receipt by any person of a Federal contract, grant, or cooperative agreement exceeding $100,000, or upon receipt of a Federal loan or loan guarantee exceeding $150,000.
(3) By any person who requests or receives from a person referred to in subsections 1 and 2 of this paragraph:
   a. A subcontract exceeding $100,000 at any tier under a Federal contract;
   b. A subgrant, contract or subcontract exceeding $100,000 at any tier under a Federal grant;
   c. A contract or subcontract exceeding $100,000 at any tier under a Federal loan exceeding $150,000;
   d. A contract or subcontract exceeding $100,000 at any tier under a Federal cooperative agreement.

D. Disclosure Forms-LLL must be filed in every instance when a person applies for, requests, or receives Federal appropriations exceeding $100,000 pursuant to a contract, subcontract, grant, subgrant, loan, or cooperative agreement when such person has paid or expects to pay any sum, in cash or in kind, to influence or attempt to influence any officer or employee of an agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress. Further, Disclosure Form-LLL must be filed by recipients at any tier at the end of each calendar quarter in which there occurs any event that requires disclosure or materially affects information submitted in prior disclosures. Such events include:

(1) 1. An increase of $25,000 in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action;
(2) 2. A change in the person(s) influencing or attempting to influence a covered action;
(3) 3. A change in the officer(s), employee(s), or member(s) contacted to influence a covered action.

All disclosure Forms-LLL, but not certifications, shall be forwarded from tier to tier until received by the principal recipient, which in turn will file them with the appropriate Federal agency.

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Use the SF-LLLA Continuation Sheet for additional information if the space on the form is inadequate. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a follow up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing there port in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying entity engaged by the reporting entity identified in item 4 to influence the covered Federal action.

    (b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. Enter the amount of compensation paid or reasonably expected to be paid by the reporting entity (item4) to the lobbying entity (item10). Indicate whether the payment has been made (actual) or will be made (planned). Check all boxes that apply. If this is a material change report, enter the cumulative amount of payment made or planned to be made.
12. Check the appropriate box(es). Check all boxes that apply. If payment is made through an in-kind contribution, specify the nature and value of the in-kind payment.
13. Check the appropriate box(es). Check all boxes that apply. If other, specify nature.
14. Provide a specific and detailed description of the services that the lobbyist has performed, or will be expected to perform, and the date(s) of any services rendered. Include all preparatory and related activity, not just time spent in actual contact with Federal officials. Identify the Federal official(s) or employee(s) contacted or the officer(s), employee(s), or Member(s) of Congress that were contacted.
15. Check whether or not a SF-LLLA Continuation Sheet(s) is attached.
16. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 30 minutes per response, including time for reviewing instructions, searching existing datasources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

DISCLOSURE OF LOBBYING ACTIVITIES

Approved by OMB 0348-0046

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352

(See reverse for public burden disclosure)

1. Type of Federal Action:	2. Status of Federal Action:	3. Report Type: N/A
[a] a. Contract a. Grant b. Cooperative agreement c. Loan d. Loan guarantee e. Loan insurance	[a] a. bid/offer/application b. initial award c. post-award	☐ a. initial finding b. material change **For Material Change Only** year_____ quarter _____ date of last report_____

4. Name and Address of Reporting Entity:	5. If Reporting Entity in No. 4 is a Subawardee, Enter Name and Address of Prime: N/A
☒ Prime ☐ Subawardee Tier _____, *if known:* J.R. Filanc Construction Company, Inc. 740 N. Andreasen Drive Escondido, CA 92029 Congressional District, *if known:*	Congressional District, *if known:*
6. Federal Department/Agency: N/A	**7. Federal Program Name/Description:** N/A CFDA Number, *if applicable:* _____
8. Federal Action Number, if known: N/A	**9. Award Amount,** if known: $ N/A
10. a. Name and Address of Lobbying Entity (if individual, last name, first name, M) N/A	**b. Individuals Performing Services** (including address if different from No. 10a) (last name, first name, MI): N/A

(attach Continuation Sheet(s) SF-LLL4, *if necessary*)

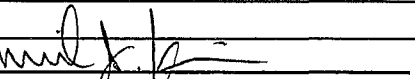
11. Amount of Payment (check all that apply)	13. Type of Payment (check all that apply) N/A
$ N/A ☐ actual ☐ planned	☐ a. retainer ☐ b. one-time lee ☐ c. commission ☐ d. contingent fee ☐ e. deferral ☐ f. other: specify:_____
12. Form of Payment (check all that apply) N/A ☐ a, cash ☐ b. in-kind: specify: nature _____ Value_____	

14. Brief Description of Services Performed or to be Performed and Date(s) of Service, Including officer(s), employee(s), or Member(s), contacted, for Payment indicated in item 11:

Filanc does not participate in lobbying activities.

(attach Continuation Sheet(s) SF-LLLA, *if necessary*)

15. Continuation Sheet(s) SF-LLLA attached: ☐ Yes ☐ No

16.	Information requested through this for misauthorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less that $10,000 and not more than $100,000 for each such failure.	Signature:  Print Name: David J. Kless Title: Vice President Telephone No.: 760-941-7130 Date: 2/25/2013

Federal Use Only:

Authorized for Local Reproduction Standard Form LLL (Rev. 7-07)

DISCLOSURE OF LOBBYING ACTIVITIES
CONTINUATION SHEET

Approved by
OMB0348-0046

Reporting Entity: J.R. Filanc Construction Company, Inc. Page 2 of 2

Authorized for Local Reproduction
Standard Form - LLL-A

Design-Build Proposal

1. The undersigned Design-Builder proposes and agrees, if this Proposal is accepted, to enter into an agreement with the City in the form included in the Contract Documents to perform the Work as specified or indicated in said Contract Documents entitled

   MBC Dewatering Centrifuges Replacement Design-Build Contract

2. The Design-Builder accepts all of the terms and conditions of the Contract Documents, including without limitation those in the RFP.

3. This Proposal will remain open for the period stated in the RFP unless otherwise required by law. The Design-Builder will enter into an agreement within the time and in the manner required in the RFP and will furnish the insurance certificates, Payment Bond, and Performance Bond required by the Contract Documents.

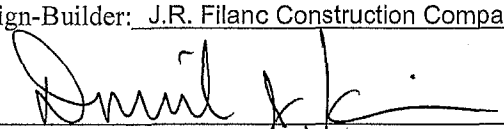
4. The Design-Builder has examined copies of all the Contract Documents including the following addenda (receipt of all of which is hereby acknowledged):

5. The Design-Builder has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality where the Work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules, and regulations), and the conditions affecting cost, progress or performance of the Work and has made such independent investigations as Design-Builder deems necessary.

To all the foregoing, and including all Proposal schedule(s) and information required of the Design-Builder contained in this Proposal Form, said Design-Builder further agrees to complete the Work and Services required under the Contract Documents within the Contract Time stipulated in said Contract Documents, and to accept in full payment therefore the Contract Price based on the Total Proposal Price(s) named in the aforementioned Proposal schedule(s).

Dated: 2/25/2013

Design-Builder: J.R. Filanc Construction Company, Inc.

By: 
(Signature)

Title: Vice President

PRICE PROPOSAL FORMS

The Bidder agrees to the design and construction of **MBC DEWATERING CENTRIFUGES REPLACEMENT DESIGN-BUILD CONTRACT**, 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.

Item No.	NAICS CODE	Description	Quantity	D*	Unit	Unit Price	Extension
1	237110	Bonds (Payment and Performance)	1		LS		$ 96,985
2	541330	Engineering, Design, & Construction Support Services	1	D	LS		$ 707,316
3	237110	Mobilization	1		LS		$ 114,785
4	237110	Removal of Equipment	1		LS		$ 168,165
5	237110	Dewatering Centrifuges	6		EA	$1,060,726.16	~~$6,364,357~~ 6364356.9
6	237110	Supporting Equipment	6		EA	$ 5,875	$ 35,250
7	238220	Mechanical	1		LS		$ 360,304
8	238210	Electrical	1		LS		$ 773,551
9	237110	Instrumentation	1		LS		$ 328,241
10	237110	City Contingency	1		AL		$425,000.00
		TOTAL FOR PROPOSAL (ITEM NO 1 THROUGH 10 INCLUSIVE):					~~$9,373,954~~ 9373953.96

*** Design Element (For City Use)**

Total Price For Design-Build Proposal, (items 1 through 10, inclusive) amount written in words:

NINE MILLION THREE HUNDRED SEVENTY THREE THOUSAND NINE HUNDRED FIFTY FOUR DOLLARS

Design-Builder: J.R. Filanc Construction Company, Inc.

Title: Vice President

Signature:

The Proposal shall contain an acknowledgment of receipt of all addenda as specified in the RFP. If an addendum or addenda has been issued by the City and not noted as being received by the Bidder, this proposal shall be rejected as being **non-responsive.**

The names of all persons interested in the foregoing proposal as principals are as follows:

David J. Kiess

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, state secretary, treasurer, and manager thereof; if a co-partnership, state true name of firm, also names of all individual co-partners composing firm; if Bidder or other interested person is an individual, state first and last names in full.

NOTES:

A. The Contract Price to be used in the selection process as described in Section 5.6 of the RFP will be determined as checked below by the City based on:

   The City shall determine the low Bid based on the Base Bid alone.

B. Prices and notations shall be in ink or typewritten. All corrections (which have been initiated by the Bidder using erasures, strike out, line out, or "white-out") shall be typed or written in with ink adjacent thereto, and shall be initialed in ink by the person signing the Proposal.

C. Failure to initial all corrections made in the proposal documents shall cause the Proposal to be rejected as **non-responsive** and ineligible for further consideration.

D. Blank spaces must be filled in, using figures. The Design-Builder's failure to submit a price for any Bid item that requires the Design-Builder to submit a price shall render the Proposal **non-responsive** and shall be cause for its rejection.

E. 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.

F. All extensions of the unit prices bid will be subject to verification by the City. In the case of inconsistency or conflict between the product of the Quantity x Unit Price and the Extension, the product shall govern.

G. In the case of inconsistency or conflict, between the sums of the Extensions with the estimated total Bid, the sum of the Extensions shall govern.

H. Proposals 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.

DESIGN-BUILD LIST OF SUBCONTRACTORS TO BE INCLUDED IN THE PRICE PROPOSAL ONLY

In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act", Division 2, Part 1, Chapter 4 of the Public Contract Code, the Design-Builder shall list below the name and address of each Subcontractor who will perform work, labor, render services or specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Design-Builder's total Bid. The Design-Builder shall also list below the portion of the work which will be done by each Subcontractor. The Design-Builder 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 shall result in the Bid being rejected as **non-responsive** and ineligible for award. The Design-Builder'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 Design-Builders' own forces. The Design-Builder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors that Design-Builder are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED ②	CHECK IF JOINT VENTURE PARTNERSHIP
Name: Hite Address: Box 771 City: San Diego State: CA Zip: 92038-0771 Phone: 858-220-1078	Constructor	Special inspection materials testing	$ 8,500	SB	State of CA	N/A
Name: Parada Painting, Inc. Address: 14281 Palisades Drive City: Poway State: CA Zip: 92064 Phone: 858-748-3540	Constructor	Painting, Coating	$ 8,000	SB	Bidsync	N/A
Name: ARCADIS Address: 1525 Faraday Ave. City: Carlsbad State: CA Zip: 92008 Phone: 760-602-3800	Designer	Engineering Services	$597,890	N/A	N/A	N/A

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14.01

① As appropriate, Design-Builder 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, Design-Builder shall indicate if Subcontractor is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC	San Diego Regional Minority Supplier Diversity Council	SRMSDC
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 Design-Builder will not receive any subcontracting participation percentages if the Design Builder fails to submit the required proof of certification (except for OBE, SLBE and ELBE).

Form Title: DESIGN-BUILD LIST OF SUBCONTRACTORS TO BE INCLUDED IN THE PRICE PROPOSAL ONLY
Form Number: AA05
Attachment D

DESIGN-BUILD LIST OF SUBCONTRACTORS TO BE INCLUDED IN THE PRICE PROPOSAL ONLY

In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act", Division 2, Part 1, Chapter 4 of the Public Contract Code, the Design-Builder shall list below the name and address of each Subcontractor who will perform work, labor, render services or specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Design-Builder's total Bid. The Design-Builder shall also list below the portion of the work which will be done by each Subcontractor. The Design-Builder 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 shall result in the Bid being rejected as **non-responsive** and ineligible for award. The Design-Builder'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 Design-Builders' own forces. The Design-Builder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors that Design-Builder are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED ②	CHECK IF JOINT VENTURE PARTNERSHIP
Name: Big Sky Electric, Inc. Address: 601 S. Milliken Ave., Ste R City: Ontario State: CA Zip: 91761 Phone: 909-390-7215	Constructor	Electrical	$437,945	SBE	NetConnect	N/A
Name: Emerson Power & Water Solutions Address: 5466 Complex St., Ste 203 City: San Diego State: CA Zip: 92123 Phone: 619-203-5082	Constructor	Programming and implementation of control systems	$261,260	N/A	N/A	N/A
Name: Address: City: State: Zip: Phone:						

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Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
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Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

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State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

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Form Title: DESIGN-BUILD LIST OF SUBCONTRACTORS TO BE INCLUDED IN THE PRICE PROPOSAL ONLY
Form Number: AA05
Attachment D

DESIGN-BUILD LIST OF SUBCONTRACTORS TO BE INCLUDED IN THE PRICE PROPOSAL ONLY ADDITIVE/DEDUCTIVE ALTERNATE

(USE ONLY WHEN ADDITIVE ALTERNATES ARE REQUIRED)

The Design-Builder shall list all Subcontractors described in the Design-Builder's Base Bid whose percentage of work will increase or decrease if alternates are selected for award. The Design-Builder shall also list additional Subcontractors not described in the Design-Builder's Base Bid who, as a result of the alternates, will perform work or labor, or render services, or specially fabricate and install a portion [type] of work or improvements in an amount in excess of 0.5%. Failure to comply with this requirement shall result in the Bid being rejected as non-responsive and ineligible for award. The Design-Builder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors that Design-Builder are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

ADDITIVE/ DEDUCTIVE ALTERNATE	NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED ②	CHECK IF JOINT VENTURE PARTNERSHIP
N/A	Name: Address: City: State: Zip: Phone:						
N/A	Name: Address: City: State: Zip: Phone:						
N/A	Name: Address: City: State: Zip: Phone:						

① As appropriate, Design-Builder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

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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		

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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 Design-Builder will not receive any subcontracting participation percentages if the Design-Builder fails to submit the required proof of certification (except for OBE, SLBE and ELBE).

BB&T Insurance Services of California, Inc.

BB&T - John Burnham Insurance Services
750 B Street, Suite 2400
San Diego, CA 92101
(619) 231-1010 Fax (619) 236-9134
CA License # 0619252

February 6, 2013

Mr. David Kiess
J.R. Filanc Construction Company, Inc.
740 N. Andreasen Drive
Escondido, CA 92029

Re: Bid Bond to the City of San Diego for MBC Dewatering Centrifuges Replacement Design-Build Contract; RFP 5573; Bid No. K-13-55-73-DB2-3

Dear David:

Enclosed is bid bond for the bond referenced above for the February 20, 2013 bid date.

Please call Tara Bacon at 619-525-2884 if you need further assistance.

Good luck with your bid!

Sincerely,

Maria Hallmark
Account Manager

Enclosure

BID BOND

KNOW ALL MEN BY THESE PRESENTS:

That we,
J.R. Filanc Construction Company, Inc.
as Principal, (hereinafter called the "Principal"), and Fidelity and Deposit Company of Maryland
, a corporation duly organized under the laws of the State of Maryland , as Surety, (hereinafter called the "Surety"), are held and firmly bound unto City of San Diego
as Obligee, (hereinafter called the "Obligee"), in the sum of Ten Percent of the Total Amount Bid Dollars ($ 10% of the total amount bid), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for

MBC Dewatering Centrifuges Replacement Design-Build Contract; RFP 5573; Bid No. K-13-55-73-DB2-3

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid and give such bond or bonds as may be specified in the bidding or contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter into such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this 6th day of February A.D., 2013

Witness

THADDEUS GARDNER, JR. GENERAL MANAGER

J.R. Filanc Construction Company, Inc.
Principal

(SEAL)

DAVID J. KIESS
ASSISTANT SECRETARY

Fidelity and Deposit Company of Maryland
Surety

By (SEAL)

Kyle King , *Attorney-in-Fact*

Minna Huovila, Account Manager *Witness*

Printed in cooperation with the American Institute of Architects (AIA) by Fidelity and Deposit Company of Maryland
Fidelity and Deposit Company of Maryland vouches that the language in the document conforms exactly to the language used in AIA Document A-310, February 1970 Edition.
BID70000ZZ0701f

ACKNOWLEDGMENT

State of California
County of San Diego

On February 6, 2013 before me, Maria Hallmark, Notary Public, personally appeared Kyle King, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person 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 _____

(Seal)

Power of Attorney
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

KNOW ALL MEN BY THESE PRESENTS: That the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, a corporation of the State of Maryland, by THEODORE G. MARTINEZ, Vice President, and ERIC D. BARNES, Assistant Secretary, in pursuance of authority granted by Article VI, Section 2, of the By-Laws of said Company, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, does hereby nominate, constitute and appoint **Bradley R. ORR, Dale G. HARSHAW, Tara BACON and Kyle KING, all of San Diego, California, EACH** its true and lawful agent and Attorney-in-Fact to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings**, and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Company, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the Company at its office in Baltimore, Md., in their own proper persons. This power of attorney revokes that issued on behalf of Bradley R. ORR, dated November 27, 2007.

FOR YOUR PROTECTION VOID
FOR THE ZURICH WATERMARK

The said Assistant Secretary does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article VI, Section 2, of the By-Laws of said Company, and is now in force.

IN WITNESS WHEREOF, the said Vice-President and Assistant Secretary have hereunto subscribed their names and affixed the Corporate Seal of the said FIDELITY AND DEPOSIT COMPANY OF MARYLAND, this 30th day of August, A.D. 2010.

ATTEST: **FIDELITY AND DEPOSIT COMPANY OF MARYLAND**

FIDELITY AND DEPOSIT COMPANY OF MARYLAND INCORPORATED 1890

By:

Eric D. Barnes *Assistant Secretary* *Theodore G. Martinez*

State of Maryland }
City of Baltimore } ss:

On this 30th day of August, A.D. 2010, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, came THEODORE G. MARTINEZ, Vice President, and ERIC D. BARNES, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and they each acknowledged the execution of the same, and being by me duly sworn, severally and each for himself deposeth and saith, that they are the said officers of the Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and that the said Corporate Seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporation.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

NOTARY PUBLIC BALTIMORE COUNTY

Maria D. Adamski *Notary Public*
My Commission Expires: July 8, 2015