THE CITY OF SAN LUIS OBISPO

SAN LUIS OBISPO, CALIFORNIA

REQUEST FOR PROPOSALS

for the procurement of the

MEMBRANE EQUIPMENT SYSTEM

for the

SAN LUIS OBISPO WATER RESOURCE RECOVERY FACILITY

Specification No. 91539A

Public Utilities Department

879 Morro Street, San Luis Obispo, CA 93401

****

July 2017

Project No. 668876 Copy No._____

SECTION 00 01 07
SEALS PAGE

SPECIFICATIONS

Digitally Signed on

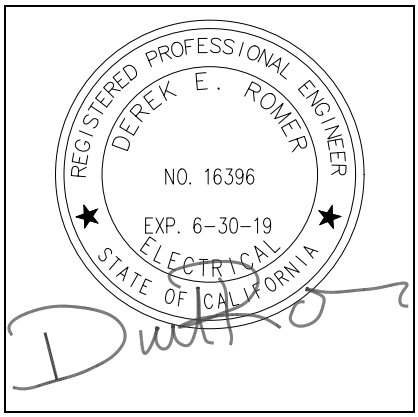
June 28, 2017

Fred Soroushian

Digitally Signed on

June 28, 2017

Ryan Stephen Harbert



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June 28, 2017

Derek E. Romer

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PART 1

BIDDING REQUIREMENTS

REQUEST FOR PROPOSALS

The City of San Luis Obispo (Owner) is inviting sealed proposals, pursuant to Specification No. 91539, from suppliers to furnish and deliver a Membrane Equipment System for the City of San Luis Obispo Water Resource Recovery Facility.

Sealed proposals for procurement of a Membrane Equipment System for the San Luis Obispo Water Resource Recovery Facility, will be received at the Finance Department, City of San Luis Obispo, 990 Palm Street, San Luis Obispo, CA 93401, until 3:00 p.m., local time, on the 8th day of August, 2017. Any proposals received after the specified time will not be considered.

Two printed copies of proposal and one electronic copy of the proposal, either on CD or USB drive shall be provided in sealed proposal envelope.

Each sealed proposal shall be clearly labeled as follows:

> "Procurement of the Membrane Equipment System for the City of San Luis Obispo Water Resource Recovery Facility," specification number, proposer name, and time and date of the proposal opening.

Proposal Opening: August 8, 2017.

The Project contemplated herein consists of furnishing goods and services for a Membrane Equipment System for the San Luis Obispo Water Resource Recovery Facility.

Proposals will be considered only from suppliers with qualifications as described in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

The attention of the Proposers is directed to the applicable Federal and State requirements and conditions of employment to be observed and minimum wage rates to be paid under the Contract.

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

Pursuant to Labor Code Sections 1725.5 and 1771.1, all contractors and subcontractors that wish to propose on, be listed in a proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. No proposal will be accepted nor any contract entered into without proof of the Supplier's and any applicable subcontractors' current registration with the Department of Industrial Relations to perform public work. If awarded a Contract, the successful Proposer and its applicable subcontractors, of any tier, shall maintain active registration with the Department of Industrial Relations for the duration of the Project.

This Project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. In proposing on this Project, it shall be the Proposer's sole responsibility to evaluate and include the cost of complying with all labor compliance requirements under this contract and applicable law in its Proposal.

Since this Project is funded in whole or in part with SRF funds, the work must also comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of Davis-Bacon. As between the State and Federal rates, if both rates apply to any portion of the work, the higher of the two rates must be paid. Attention is directed to the SRF Funding Requirements Supplement section of the Contract Documents.

Proposal Documents may be obtained electronically from the City's website, Proposals page at www.slocity.org. Questions from Proposers shall also be posted to the website.

Each Proposal must be submitted on the prescribed Proposal Form and accompanied by Proposal security as prescribed in the Instructions to Proposers, payable to the Buyer in an amount not less than 10 percent of the Proposal amount.

Successful Proposer will be required to furnish the additional Bond(s) prescribed in Proposal Documents.

In order to propose and perform public work, the Supplier shall hold or obtain such licenses as required by State Statutes, and Federal and local laws and regulations. The Supplier must have a valid City of San Luis Obispo business license and tax certificate before execution of the Contract. Additional information regarding the City's business license and tax program may be obtained by calling (805) 781-7134. Failure to possess specified licenses at time of award shall render Proposal nonresponsive.

State Revolving Loan funds will be used for Project funding. The Supplier shall comply with all of the requirements for State Revolving Loan funding as described in supplement, herein and shall submit all forms, including the Disadvantaged Business Enterprise (DBE) forms as part of the Proposal. Prospective Sellers must complete and submit SRF DBE forms 4500-3 and 4500-4 WITH their Proposals, whether or not the Seller intends to utilize DBE subcontractors or suppliers on the Contract.

For information concerning the proposed Project, contact Jennifer Phillips at Jennifer.Phillips16@ch2m.com.

Buyer's right is reserved to reject all Proposals or any Proposal not conforming to the intent and purpose of the Proposal Documents.

Dated this 28th day of June, 2017.

END OF SECTION

Supplement to Request for Proposals

Project Requirements

SRF FUNDING REQUIREMENTS

State Revolving Fund (SRF) loans will be used to fund the Project and the California SRF requirements apply to the project.

The Supplier shall meet the following SRF requirements for applicable labor and materials:

- Davis Bacon Wage Rates
- American Iron and Steel
- Disadvantaged Business Enterprise (DBE) requirements

Additionally, the Supplier shall meet the following requirements:

1. STATE FAIR EMPLOYMENT AND HOUSING ACT.

(a) Supplier shall comply with the provisions of the Fair Employment and Housing Act and the applicable regulations promulgated thereunder. (Gov. Code, §12990, subds. (a)-(f) et seq.;Cal. Code Regs., tit. 2, § 7285 et seq.) Such regulations are incorporated into this Agreement by reference and made a part hereof as if set forth in full.

(b) Supplier shall give written notice of its obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

2. STATE NON-DISCRIMINATION PROVISIONS.

(a) During the performance of this Agreement, Supplier shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, sexual orientation, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), age (over 40), marital status, denial of family care leave, or genetic information, gender, gender identity, gender expression, or military and veteran status.

(b) Supplier shall ensure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment.

3. TRAFFICKING IN PERSONS. Supplier, its employees, contractors and subcontractors and their employees may not engage in severe forms of trafficking in persons during the term of this Agreement, procure a commercial sex act during the term of this Agreement, or use forced labor in the performance of this Agreement. Supplier must include this provision in its contracts and subcontracts under this Agreement. Supplier must inform the Buyer immediately of any information regarding a violation of the foregoing. The Buyer may unilaterally terminate this Agreement if Supplier is determined to have violated the foregoing. Trafficking Victims Protection Act of 2000.

4 CONTRACTORS, SUBCONTRACTORS, DEBARMENT AND SUSPENSION. Executive Order 12549; 2 CFR Part 180; 2 CFR Part 1532. Supplier shall not subcontract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549, "Debarment and Suspension". Supplier shall not subcontract with any individual or organization on USEPA's List of Violating Facilities. (40 CFR, Part 31.35, Gov. Code 4477). Supplier certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any federal department or agency;

(b) Have not within a three (3) year period preceding this Agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and

(d) Have not within a three (3) year period preceding this application/proposal had one or more public transactions (federal, state or local) terminated for cause or default.

Suspension and debarment information can be accessed at http://www.sam.gov. Supplier represents and warrants that it has or will include a term or conditions requiring compliance with this provision in all of its contracts and subcontracts entered into pursuant to this Agreement. Supplier acknowledges that failing to disclose the information as required at 2 CFR 180.335 may result in the termination, delay or negation of the Contract, or pursuance of legal remedies, including suspension and debarment.

5. DEBARMENT AND SUSPENSION EXECUTIVE ORDER NO. 12549 (1986). Supplier certifies that it is not ineligible and certifies that it will not knowingly enter into a contract with anyone who is ineligible under the 40 CFR Part 32 to participate in the Project.

6. WAGE RATE REQUIREMENTS (DAVIS-BACON). Supplier shall comply with and shall include in full the applicable language provided in Exhibit 1, in all applicable subcontracts. Exhibit 1 is incorporated herein by reference.

7. ANTI-LOBBYING PROVISIONS (40 CFR PART 34) & ANTI-LITIGATION PROVISIONS (2 CFR 220, 225, OR 230). Supplier shall ensure that no funds under this Agreement are used to engage in lobbying of the federal government or in litigation against the United States unless authorized under existing law. Supplier shall abide by 2 CFR 225 (OMB Circular A-87) (or, if not applicable, other parallel requirements), which prohibits the use of federal grant funds for litigation against the United States or for lobbying or other political activities. Supplier agrees to comply with 40 CFR Part 24, New Restrictions on Lobbying. Supplier agrees to submit certification and disclosure forms in accordance with these provisions. In accordance with the Byrd Anti-Lobbying Amendment, any Supplier who makes a prohibited expenditure under 40 CFR Part 34 or fails to file the required

certification or lobbying forms shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure. Supplier shall abide by its respective 2 CFR 200, 225, or 230, which prohibits the use of federal grant funds for litigation against the United States or for lobbying or other political activities.

Supplier certifies that to the best of his/ her knowledge and belief no state, federal or local agency appropriated funds have been paid, or will be paid by or on behalf of the Consultant to any person for the purpose of influencing or attempting to influence an officer or employee of any state or federal agency; a Member of the State Legislature or United States Congress; an officer or employee of the Legislature or Congress; or any employee of a Member of the Legislature or Congress, in connection with the award of any state or federal contract, grant, loan, or cooperative agreement, or the extension, continuation, renewal, amendment, or modification of any state or federal contract, grant, loan, or cooperative agreement.

a) If any funds other than federal appropriated funds have been paid, or will be paid to any person for the purpose of influencing or attempting to influence an officer or employee of any federal agency; a Member of Congress; an officer or employee of Congress, or an employee of a Member of Congress; in connection with this Agreement, the Supplier shall complete and submit the attached Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with the attached instructions.

b) Supplier’s certification provided in this section is a material representation of fact upon which reliance was placed when this Agreement was entered into, and is a prerequisite for entering into this Agreement.

c) Supplier also agrees by signing this Agreement that he/she shall require that the language set forth in this section be included in all Supplier’s subcontracts which exceed $100,000, and that all such subcontractors shall certify and disclose accordingly.

8. FEDERAL NON-DISCRIMINATION REQUIREMENTS - EXECUTIVE ORDER NO. 11246. Supplier shall comply with and shall include in its subcontracts related to the Project the following provisions. As used below “contractor” shall refer to Supplier.

"During the performance of this contract, the contractor agrees as follows:

"(a) The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, 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, creed, color, or national origin. Such action shall include, but 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 by the contracting officer setting forth the provisions of this nondiscrimination clause.

"(b) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

"(c) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

"(d) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

"(e) The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

"(f) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

"(g) The contractor will include the provisions of Paragraphs (a) through (g) 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 No. 11246 of Sept. 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 contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, That in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States."

EXHIBIT 1
DAVIS BACON PROVISIONS

For purposes of this Exhibit only, “subrecipient” or “sub recipient” means the City of San Luis Obispo.

For purposes of this Exhibit only, “recipient” means the State Water Board.

For purposes of this Exhibit only, “contractor” means Supplier.

1. Requirements for Sub recipients that are Governmental Entities.

If a sub recipient has questions regarding when Davis-Bacon (DB) applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State Water Board. The recipient or sub recipient may also obtain additional guidance from DOL’s web site at http://www.dol.gov/whd/.

2. Applicability of the Davis-Bacon (DB) prevailing wage requirements.

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a sub recipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the sub recipient must discuss the situation with the recipient State before authorizing work on that site.

3. Obtaining Wage Determinations.

(a) Sub recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the sub recipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The sub recipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the sub recipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the sub recipient.

(ii) If the sub recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the sub recipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The sub recipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of

closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the sub recipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the sub recipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Sub recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a sub recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the sub recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the sub recipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The sub recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

4. Contract and Subcontract Provisions.

(a) The Recipient shall insure that the sub recipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF - financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the Consolidated Appropriations Act, 2016, the following clauses:

(1) Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work 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).

California State Water Resources Control Board
Division of Financial Assistance
1001 I Street • Sacramento, California 95814 • (916) 341-5700 FAX (916) 341-5707
Mailing Address: P. O. Box 944212 • Sacramento, California • 94244-2120
Internet Address: http://www.waterboards.ca.gov

Guidelines for Meeting the California State Revolving Fund (CASRF) Programs (Clean Water and Drinking Water SRF) Disadvantaged Business Enterprise Requirements

The Disadvantaged Business Enterprise (DBE) Program is an outreach, education, and objectives program designed to increase the participation of DBEs in the Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) Programs.

How to Achieve the Purpose of the Program

Recipients of CWSRF/DWSRF financing that are subject to the DBE requirements (recipients) are required to seek, and are encouraged to use, DBEs for their procurement needs. Recipients should award a "fair share" of sub-agreements to DBEs. This applies to all sub-agreements for equipment, supplies, construction, and services.

The key functional components of the DBE Program are as follows:

- Fair Share Objectives
- DBE Certification
- Six Good Faith Efforts
- Contract Administration Requirements
- DBE Reporting

Disadvantaged Business Enterprises are:

- Entities owned and/or controlled by 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;
- Minority Business Enterprise (MBE) - entities that are at least 51% owned and/or controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note), and Public Law 102-389 (42 U.S.C. 4370d), respectively;
- Women Business Enterprise (WBE) - entities that are at least 51% owned and/or controlled by women;
- Small Business Enterprise (SBE);
- Small Business in a Rural Area (SBRA);
- Labor Surplus Area Firm (LSAF); or
- Historically Underutilized Business (HUB) Zone Small Business Concern or a concern under a successor program.

Certifying DBE Firms:

Under the DBE Program, entities can no longer self-certify and contractors and sub-contractors must be certified at bid opening. Contractors and sub-contractors must provide to the CASRF recipient proof of DBE certification. Certifications will be accepted from the following:

- The U.S. Environmental Protection Agency (USEPA)
- The Small Business Administration(SBA)
- The Department of Transportation's State implemented DBE Certification Program (with U.S. citizenship)
- Tribal, State and Local governments
- Independent private organization certifications

If an entity holds one of these certifications, it is considered acceptable for establishing status under the DBE Program.

Six Good Faith Efforts (GFE)

All CWSRF/DWSRF financing recipients are required to complete and ensure that the prime contractor complies with the GFE below to ensure that DBEs have the opportunity to compete for financial assistance dollars.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practical through outreach and recruitment activities. For Tribal, State and Local 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. Posting solicitations for bids or proposals for a minimum of 30 calendar days in a local newspaper, before the bid opening date.
3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs.
4. Encourage contracting with a group of DBEs when a contract is too large for one firm to handle individually.
5. Use the services of the SBA **and/or** Minority Business Development Agency (MBDA) of the US Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the above steps.

The forms listed in the table below and attached to these guidelines; must be completed and submitted with the GFE:

FORM NUMBER	FORM NAME	REQUIREMENT	PROVIDED BY	COMPLETED BY	SUBMITTED TO
SWRCB Form 4500-2 or EPA Form	**DBE Sub-Contractor Participation Form**	**As Needed to Report Issues**	**Recipient**	**Sub-contractor**	**EPA DBE Coordinator**
SWRCB Form 4500-3 or EPA Form	**DBE Sub-Contractor Performance Form**	**Include with Bid or Proposal Package**	**Prime Contractor**	**Sub-Contractor**	**SWRCB by Recipient**
SWRCB Form 4500-4 or EPA Form	**DBE Sub-Contractor Utilization Form**	**Include with Bid or Proposal Package**	**Recipient**	**Prime Contractor**	**SWRCB by Recipient**

The completed forms must be submitted with each Bid or Proposal. The recipient shall review the bidder's documents closely to determine that the GFE was performed **prior** to bid or proposal opening date. Failure to complete the GFE and to substantiate completion of the GFE before the bid opening date could jeopardize CWSRF/DWSRF financing for the project. The following situations and circumstances require action as indicated:

1. If the apparent successful low bidder was rejected, a complete explanation must be provided.

2. Failure of the apparent low bidder to **perform** the GFE **prior** to bid opening constitutes a non-responsive bid. The construction contract may then be awarded to the next low, responsive, and responsible bidder that meets the requirements or the Recipient may re-advertise the project.

3. If there is a bid dispute, all disputes shall be settled **prior** to submission of the Final Budget Approval Form.

Administration Requirements

- A recipient of CWSRF/DWSRF financing must require entities receiving funds to create and maintain a Bidders List if the recipient of the financing agreement is subject to, or chooses to follow, competitive bidding requirements.
- The Bidders list must include all firms that bid or quote on prime contracts, or bid or quote on subcontracts, including both DBEs and non-DBEs.

- Information retained on the Bidder's List must include the following:
    1. Entity's name with point of contact;
    2. Entity's mailing address and telephone number;
    3. The project description on which the entity bid or quoted and when;
    4. Amount of bid/quote; and
    5. Entity's status as a DBE or non-DBE.
- The Bidders List must be kept until the recipient is no longer receiving funding under the agreement.
- The recipient shall include Bidders List as part of the Final Budget Approval Form.
- A recipient must require its prime contractor to pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the Recipient.
- A recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor by the prime contractor.
- If a DBE subcontractor fails to complete work under the subcontract for any reason, the recipient must require the prime contractor to employ the six GFEs if soliciting a replacement subcontractor.
- A recipient must require its prime contractor to employ the six GFEs even if the prime contractor has achieved its fair share objectives.

Reporting Requirements

For the duration of the construction contract(s), the recipient is required to submit to the State Water Resources Control Board DBE reports annually by October 10 of each fiscal year on the attached Utilization Report form (UR-334). Failure to provide this information as stipulated in the financial agreement language may be cause for withholding disbursements.

CONTACT FOR MORE INFORMATION

SWRCB, CASRF – Barbara August (916) 341-6952 barbara.august@waterboards.ca.gov

US EPA, Region 9 – Joe Ochab (415) 972-3761 ochab.joe@epa.gov

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Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Participation Form

A Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity	

Contract Item Number	**Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies**	**Amount Received by Prime Contractor**

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

Please use the space below to report any concerns regarding the above funded project:

Subcontractor Signature	Print Name
Title	Date

The public reporting and record keeping burden for this collection of information is estimated to average three (3) hours per response. 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, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Do not send the completed form to this address.

Send completed Form 4500-2 to:
Mr. Joe Ochab, DBE Coordinator
US EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

FORM 4500-2 (DBE Subcontractor Participation Form)

Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. A Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractor's bid or proposal package.

Subcontractor Name	Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity	

Contract Item Number	**Description of Work Submitted from the Prime Contractor Involving Construction, Services, Equipment or Supplies**	**Price of Work Submitted to the Prime Contractor**
DBE Certified By: _ DOT _ SBA Other: _____	Meets/exceeds EPA certification standards? YES NO Unknown	

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractor's[2] and the estimated dollar amount of each subcontract. A Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity		

I have identified potential DBE certified subcontractors. YES NO

If *yes*, please complete the table below. If *no*, please explain:

Subcontractor Name/ Company Name	**Company Address / Phone / Email**	**Estimated Dollar Amount**	**Currently DBE Certified?**

--Continue on back if needed--

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

STATE WATER RESOURCES CONTROL BOARD – DIVISION OF FINANCIAL ASSISTANCE
DISADVANTAGED BUSINESS ENTERPRISE (DBE) UTILIZATION
CALIFORNIA STATE REVOLVING FUNDS (CASRF)
FORM UR-334

1. Grant/Finance Agreement Number:	2. Annual Reporting Period 10/1/___ through 09/30/_	3. Purchase Period of Financing Agreement:
4. Total Payments Paid to Prime Contractor or Sub-Contractors During Current Reporting Period: $		
5. Recipient's Name and Address:	6. Recipient's Contact Person and Phone Number:	

7. List All DBE Payments Paid by Recipient or Prime Contractor During Current Reporting Period:

Payment or Purchase Paid by Recipient or Prime Contractor	Amount Paid to Any DBE Contractor or Sub-Contractor For Service Provided to Recipient		Date of Payment (MM/DD/YY)	Procurement Type Code** (see below)	Name and Address of DBE Contractor of Sub-Contractor or Vendor
	MBE	WBE			

8. Initial here if no DBE contractors or sub-contractors paid during current reporting period:
9. Initial here if all procurements for this contract are completed:
10. Comments:

11. Signature and Title of Recipient's Authorized Representative	12. Date

Email Form UR-334 to:

DrinkingWaterSRF@waterboards.ca.gov OR CleanWaterSRF@waterboards.ca.gov

Questions may be directed to:

Barbara August, SWRCB
Barbara.August@waterboards.ca.gov
Phone: (916) 341-6952
Fax: (916) 327-7469

****Procurement Type:**
1. Construction
2. Supplies
3. Services (includes business services; professional services; repair services and personnel services)
4. Equipment

STATE WATER RESOURCES CONTROL BOARD - DIVISION OF FINANCIAL ASSISTANCE
DISADVANTAGED BUSINESS ENTERPRISE (DBE) UTILIZATION
CALIFORNIA STATE REVOLVING FUNDS

INSTRUCTIONS FOR COMPLETING FORM UR-334

Box 1 Grant or Financing Agreement Number.

Box 2 Annual reporting period.

Box 3 Enter the dates between which you made procurements under this financing agreement or grant.

Box 4 Enter the total amount of payments paid to the contractor or sub-contractors during this reporting period.

Box 5 Enter Recipient's Name and Address.

Box 6 Enter Recipient's Contact Name and Phone Number.

Box 7 Enter details for the **DBE purchases only** and be sure to limit them to the current period. 1) Use either an "R" or a "C" to represent "Recipient" or "Contractor." 2) Enter a dollar total for DBE and total the two columns at the bottom of the section. 3) Provide the payment date. 4) Enter a product type choice from those at the bottom of the page. 5) List the vendor name and address in the right-hand column

Box 8 Initial here if no DBE contractors or sub-contractors were paid during this reporting period.

Box 9 Initial this box only if all purchases under this financing agreement or grant have been completed during this reporting period or a previous period. If you initial this box, we will no longer send you a survey.

Box 10 This box is for explanatory information or questions.

Box 11 Provide an authorized representative signature.

Box 12 Enter the date form completed.

INSTRUCTIONS TO PROPOSERS

1. DEFINED TERMS.

1.1. Terms used in these Instructions to Proposers have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Proposers have the meanings indicated below which are applicable to both the singular and plural thereof:

1.1.1. *Issuing Office* – The office from which the Proposal Documents are to be issued and where the Proposal procedures are to be administered.

1.1.2. *Proposal* – A complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Proposal Documents.

1.1.3. *Proposal Requirements* – Consist of the Request for Proposals, Instructions to Proposers, Proposal security, the Proposal Form and other Proposal and contract forms.

1.1.4. *Buyer* – The Contract will be executed in the name of the Owner as the Buyer initially and will be assigned at a later date to a Construction Contractor (assignee) designated by the Buyer.

1.1.5. *Construction Contractor (Installing Contractor)* – Contractor responsible for constructing the San Luis Obispo Water Resource Recovery Facility project. The Membrane Equipment System will be assigned to the Construction Contractor after the Contractor is selected.

1.1.6. *Days* – Defined as Calendar Days.

1.1.7. *Engineer* – Engineer responsible for designing the San Luis Obispo Water Resource Recovery Facility project.

1.1.8. *Owner* – The City of San Luis Obispo.

1.1.9. *Supplier (Seller, Proposer)* – Company supplying the Membrane Equipment System goods and services.

1.1.10. *Point of Destination* – The City of San Luis Obispo Water Resource Recovery Facility, 35 Prado Road, San Luis Obispo, CA 93401.

2. PROPOSALS RECEIVED.

2.1. Refer to Request for Proposals for information on receipt of Proposals.

3. COPIES OF PROPOSAL DOCUMENTS.

3.1. The Proposal Documents can be obtained electronically as stated in the Request for Proposals.

3.2. Complete sets of Proposal Documents shall be used in preparing Proposals; neither Buyer nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Proposal Documents.

3.3. Buyer and Engineer, in making copies of Proposal Documents available on the above terms, do so only for the purpose of obtaining Proposals for furnishing Goods and Special Services and do not confer a license or grant for any other use.

4. QUALIFICATIONS OF PROPOSERS.

4.1. Proposer's qualifications shall, at a minimum, meet the requirements of Section 43 32 56, Membrane Equipment System (Membrane Bioreactor). Proposer shall submit written evidence, such as financial data, previous experience, and other such data as may be called for in the Proposal Documents.

4.2. Proposer is advised to carefully review those portions of Proposal Form requiring Proposer's representations and certifications.

5. LICENSE REQUIREMENTS.

5.1. The Proposer shall comply with the licensing requirements for award of the Contract for the Work as listed in the Request for Proposals.

6. EXAMINATION OF PROPOSAL DOCUMENTS, OTHER RELATED DATA, AND POINT OF DESTINATION.

Upon request, Buyer will provide Proposer access to the Point of Destination and the site where Goods are to be installed or Special Services are to be provided so that Proposer may conduct such investigations, examinations, tests, and studies as Proposer deems necessary for submission of a Proposal. Proposers are allowed to have "reasonable" access and will be subject to Buyer's direction when onsite. Proposer will be required to sign the Right of Entry Agreement included in the Proposal Documents as a condition of access to the Point of Destination.

6.1. It is the responsibility of each Proposer, before submitting a Proposal, to:

6.1.1. Examine and carefully study Proposal Documents, including Addenda, State Revolving Fund (SRF) requirements and related data identified in Proposal Documents.

6.1.2. If specified or, if in Proposer's judgment, any local condition may affect cost, progress, or furnishing of Goods and Special Services, visit the Point of Destination and the site where the Goods are to be installed and Special Services are to be provided to become familiar with local conditions.

6.1.3. Become familiar with and satisfy itself as to Laws and Regulations that may affect cost, progress, or furnishing of Goods and Special Services.

6.1.4. Carefully study, consider, and correlate information known to Proposer; information commonly known to Sellers of similar Goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Proposer's visits, if any, to the Point of Destination and the site where the Goods are to be installed or Special Services are to be provided; and any reports and drawings identified in the Proposal Documents regarding Point of Destination and site where Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under Contract Documents.

6.1.5. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Proposer discovers in Proposal Documents and confirm that the written resolution thereof by Engineer is acceptable to Proposer.

6.1.6. Determine that Proposal Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services.

7. MANDATORY PREPROPOSAL CONFERENCE.

7.1. A Mandatory Preproposal Conference will be held at the San Luis Obispo Water Resource Recovery Facility Administration Building Conference Room at 35 Prado Road, San Luis Obispo, CA, on the 7th day of July at 1:30 p.m. Proposers are required to attend and participate in the conference. Questions from Proposers received in the preproposal meeting requiring response will be addressed separately by Addenda. Oral statements may not be relied upon and will not be binding or legally effective.

8. INTERPRETATIONS AND ADDENDA.

8.1. All questions about the meaning or intent of Proposal Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Issuing Office as having received Proposal Documents. Questions received less than 10 days prior to the date for

opening of Proposals may not be answered. Only information provided by Addenda will be binding. Oral statements and other interpretations may not be relied upon and will not be binding or legally effective.

8.2. Addenda may be issued to clarify, correct, or change Proposal Documents as deemed advisable by Buyer or Engineer.

9. PROPOSAL SECURITY.

9.1. Proposal must be accompanied by Proposal security made payable to Buyer, in an amount of 10 percent of Proposer's maximum Proposal price and in the form of a certified or bank check or a Proposal Bond on form attached, issued by a surety meeting requirements of Paragraph 4.01.B of the General Conditions.

9.2. The Proposal security of the apparent Successful Proposer will be retained until such Proposer has executed the Contract Documents, furnished required contract security, and met other conditions of the Notice of Award. If apparent Successful Proposer fails to execute and deliver the Contract Documents, and furnish required bonds and evidence of insurance within 15 days after the Notice of Award, Buyer may consider Proposer to be in default, annul the Notice of Award, and Proposal security of that Proposer will be forfeited. The Proposal security of other Proposers that Buyer believes to have a reasonable chance of receiving award may be retained by Buyer until the earlier of 7 days after Effective Date of the Agreement or 61 days after Proposal opening.

10. SUBMITTALS.

10.1. Refer to Section 01 30 00, Administrative Requirements, for Submittals required during design and after contract award and submittals required during construction/after the Contract is assigned.

11. CONTRACT TIMES.

11.1. See applicable provisions in the Agreement Form.

12. PROCUREMENT PROCESS.

12.1. The procurement process that the Buyer anticipates following is described below:

Activity	Anticipated Date	Purpose
Issue Addenda, as required, to Contract Documents	July 28, 2017	Final communication of scope of supply and basis of Contract Award

Activity	Anticipated Date	Purpose
Due date for Proposals from Membrane System Proposers	August 8, 2017	Begin Proposal Review Process
Recommend Award of Contract to Owner	August 22, 2017	Provide Engineer's recommendation of Award
Issue Notice to Proceed to Successful Proposer	August 30, 2017	Initiate Contract Time

13. LIQUIDATED DAMAGES.

13.1. Provisions for liquidated damages such as those for Seller's failure to attain a Milestone, or to deliver the Goods or furnish Special Services within the Contract Times, are set forth in the Agreement and in Section 01 29 00, Measurement and Payment.

14. "OR-EQUAL" ITEMS.

14.1. Pursuant to Public Contract Code Section 3400(b), if the City has made any findings designating certain materials, products, things, or services by specific brand or trade name, such findings and the materials, products, things, or services and their specific brand or trade names will be set forth in the Supplementary Conditions/Specifications. The procedure for submittal of an application for consideration of "or-equal" items by Seller and consideration by Engineer, except where specific findings have been made, is set forth in the General Conditions and may be supplemented in the General Requirements.

15. PREPARATION OF PROPOSAL.

15.1. The Proposal Form, Proposal Schedules, and Proposal Bond are included with Proposal Documents. All forms and schedules shall be completed by the Proposer in their entirety, including responses to all questions and all information shall be provided as requested in the Proposal Schedules.

15.2. Complete all Section 00 41 63, Proposal Form, Schedules and Supplements as required in Section 00 21 14, Instructions to Proposers, and Section 00 41 63, Proposal Form.

15.3. Information provided with the Proposal Documents shall be for the purpose of determining the responsiveness of the Proposal, and shall be used by the Buyer in selecting the successful Seller. Information in the proposals will be used to evaluate the proposers' ability to meet the requirements of the contract.

15.4. Failure to complete and include all forms in their entirety may deem the Proposal nonresponsive.

15.5. All blanks on Proposal Form shall be completed in ink and the Proposal Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Proposal Form. A Proposal price shall be indicated for each Proposal item listed therein, or the words "No Proposal," "No Change," or "Not Applicable" entered.

15.6. A Proposal by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal must be affixed and attested by the secretary or an assistant secretary.

15.7. A Proposal by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear on the line below the signature), accompanied by evidence of authority to sign.

15.8. A Proposal by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign.

15.9. A Proposal by an individual shall show the Proposer's name and official address.

15.10. A Proposal by a joint venture shall be executed by each joint venture partner in the manner indicated on the Proposal Form.

15.11. All names must be typed or printed in ink below the signatures.

15.12. The Proposal shall contain an acknowledgement of receipt of all Addenda; the numbers of which shall be filled in on the Proposal Form. Failure to acknowledge receipt will cause Proposal to be considered in non-responsive.

15.13. Each Proposer shall list the postal address, e-mail address, and telephone number for communications regarding the Proposal.

16. PROPOSAL PRICE AND LIFECYCLE COSTS.

16.1. The Proposal Price shall be as provided by Proposer on Proposal Schedule "A" Lifecycle Cost Evaluation Form, Item F.1. Proposal Price includes lump sum costs.

16.1.1. Proposals shall be compared based on total present worth cost as provided by Proposer on Proposal Schedule "A" Lifecycle Cost Evaluation Form, Item F.5.

16.1.2. Lifecycle costs and timeframe shall be as indicated in Proposal Schedule "A".

16.1.3. Prices quoted shall be f.o.b. Point of Destinations with freight and full insurance paid by Proposer. After the Proposer delivers the equipment system to the Point of Destination, the Construction Contractor will offload the equipment.

17. SUBMISSION OF PROPOSAL.

17.1. The following Proposal Documents are to be completed in their entirety, with all forms completed and all information provided as requested and submitted with the Proposal. Proposals will be considered nonresponsive if they do not include the required information in the Proposal Schedules as requested. The following Proposal Documents and those items required in Section 01 30 00, Administrative Requirements, are to be completed and submitted with the proposal

17.1.1. Proposal Form.

17.1.2. Proposal Schedule “A” Lifecycle Cost Evaluation Form and Worksheets.

17.1.3. Proposal Schedule “B” Warranties and Service Contracts.

17.1.4. Proposal Schedule “C” Technical Data for Membrane Equipment System.

17.1.5. Proposal Schedule “D” Scope of Supply.

17.1.6. Proposal Schedule “E” Drawings.

17.1.7. Proposal Schedule “F” Production Capacity.

17.1.8. Proposal Schedule “G” Supervision of Installation and Performance Testing, Operator Training and Maintenance Instructions.

17.1.9. Proposal Schedule “H” Special Tools and Spare Parts List.

17.1.10. Proposal Schedule “I” O&M Considerations.

17.1.11. Proposal Schedule “J” Project Implementation.

17.1.12. Proposal Schedule “K” MBR Experience.

17.1.13. Proposal Schedule “L” Corporate Responsibility.

17.1.14. Proposal Schedule “M” Performance Requirements.

17.1.15. Proposal Schedule “N” Baseline Water Quality Conditions.

17.1.16. Proposal Schedule “O” Additional Forms.

17.1.17. Proposal Bond or other Proposal Security.

17.1.18. SRF - DBE forms 4500-3 and 4500-4.

17.2. Details and conditions of the warranties and service contracts described in Proposal Schedule "B" shall be provided with the Proposal. Any other pertinent details to the Proposal Schedules shall be provided with the Proposal. All information shall be clearly labeled, bound and organized in the Proposal.

17.3. The Proposer may identify exceptions or recommendations as described in Section 01 30 00, Administrative Requirements, Article Information Required with Proposal Document, Paragraph B. Exceptions related to the items in the following list will not be accepted.

17.3.1. Performance Acceptance Test in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

17.3.2. Range of Biomass Solids Retention Times included Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

17.3.3. The 4-day duration of Maximum Equalized Flow operation with one train out of service required in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

17.4. The Proposer shall label any proprietary information as confidential. Proposer acknowledges and agrees that the proposal including all materials submitted to the City are subject to the provisions of the Public Records Act (Government Code Sections 6250 et seq.) Proposer should be aware that marking information as confidential does not affect the City's obligations under the Public Records Act, and the City may be required to disclose proprietary information marked as confidential. The City shall not be responsible or liable to Proposer or any other person for the disclosure of materials marked as confidential.

17.5. Proposal shall be submitted and received by Buyer no later than the date and time prescribed and at place indicated in Request for Proposals and shall be enclosed in an opaque sealed envelope plainly marked with Project title, name, and address of Proposer and shall be accompanied by Proposal security and other required documents. If Proposal is sent by mail or other delivery system, sealed envelope containing Proposal shall be enclosed in a separate package plainly marked on outside with notation "PROPOSAL ENCLOSED," and addressed as indicated in Invitation to Proposal.

18. MODIFICATION OR WITHDRAWAL OF PROPOSAL.

18.1. A Proposal may be modified or withdrawn by an appropriate document duly executed in the same manner that a Proposal must be executed, and received at the place where Proposals are to be submitted prior to the date and time for the opening of Proposals.

18.2. A proposal may be withdrawn after the date and time for opening Proposals only as provided in Public Contract Code Section 5100 et seq. The request must be submitted to Buyer in writing and received by Buyer within 5 working days, excluding Saturday, Sunday, and State holidays, after the date Proposals are received specifying in detail how the mistake was made.

19. OPENING OF PROPOSALS.

19.1. Proposals will be opened at the time and place indicated in Request for Proposals and read aloud publicly. An abstract of the amounts of the Base Proposals and Alternate Proposals, if any, will be made available to Proposers after opening of Proposals.

20. PROPOSALS TO REMAIN SUBJECT TO ACCEPTANCE.

20.1. All Proposals will remain subject to acceptance for the period of time stated in Proposal Form, but Buyer may, in its sole discretion, release any Proposal and return Proposal security prior to end of this period.

21. BASIS OF AWARD; AWARD OF CONTRACT.

21.1. If a contract is awarded, contract shall be based on lowest present worth cost as provided by Proposer on Proposal Schedule “A” Lifecycle Cost Evaluation Form, Item F.5 and shall be based on Proposer meeting specified qualifications and providing a responsive proposal.

21.2. Buyer reserves its right to reject any and all Proposals, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Proposals. Proposals will be considered nonresponsive if forms and schedules are incomplete and do not respond to the questions in the forms and schedules. Proposals shall include all State Revolving Fund forms as described in this Request for Proposals. Buyer further reserves the right to reject the Proposal of any Proposer that Buyer finds, after reasonable inquiry and evaluation, to be nonresponsible. Buyer may also reject the Proposal of any Proposer if Buyer believes that it would not be in the best interest of the Project to make an award to that Proposer. Buyer also reserves the right to waive informalities or irregularities not involving price, time or material changes in Goods and Special Services, and to negotiate contract terms with Successful Proposer.

21.3. More than one Proposal for the same Goods and Special Services from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Proposer has an interest in more than one Proposal for Goods and Special Services shall be cause for disqualification of that Proposer and rejection of all Proposals in which that Proposer has an interest.

21.4. In evaluating Proposals, Buyer will consider whether or not Proposals comply with prescribed requirements, and such alternatives, unit prices and other data, as may be requested in Proposal Form or may be requested from Proposers prior to a Notice of Award.

21.5. Buyer may conduct such investigations as Buyer deems necessary to establish responsibility, qualifications, and financial ability of Proposer.

21.6. If Contract is to be awarded, Buyer will award Contract to the responsible Proposer whose Proposal offers the lowest present worth cost determined in accordance with the provisions of these Proposal Documents and meeting the requirements of the Contract Documents.

22. CONTRACT SECURITY AND INSURANCE.

22.1. Article 4 of General Conditions and Article 4 of Supplementary Conditions set forth Buyer's requirements as to furnishing bonds and insurance. When Successful Proposer delivers executed Agreement to Buyer, it must be accompanied by the required bonds and evidence of insurance. Each Proposer shall submit the Contractor's Certificate Regarding Workers' Compensation form.

23. DEBARMENT OF CONTRACTORS AND SUBCONTRACTORS.

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

24. IRAN CONTRACTING ACT CERTIFICATION.

24.1. Each bidder shall submit the certification required by the Iran Contracting Act of 2010, Public Contract Code Section 2200 et seq. with its bid. The certification is included in the Proposal Documents.

25. PUBLIC WORKS CONTRACTOR REGISTRATION CERTIFICATION.

25.1. Pursuant to Labor Code Sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. No bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors' current registration with the Department of Industrial Relations to perform public work. If awarded a Contract, the Bidder and its subcontractors, of any tier, shall maintain active registration with the Department of Industrial Relations for the duration of the Project. To this end, Bidder shall sign and submit with its Bid the Public Works Contractor Registration Certification on the form provided, attesting to the facts contained therein. Failure to submit this form may render the Bid nonresponsive.

26. SALES AND OTHER APPLICABLE TAXES, PERMITS, LICENSES AND FEES.

26.1. Proposer and its subcontractors performing work under this Contract will be required to pay California sales tax and other applicable taxes, and to pay for permits, licenses and fees required by the agencies with authority in the jurisdiction in which the work will be located, unless otherwise expressly provided by the Contract Documents. Proposers shall include all applicable taxes and fees that are in effect or reasonably anticipated on the bid date in their bid price.

27. SIGNING OF AGREEMENT.

27.1. When Buyer issues a Notice of Award to Successful Proposer, it shall be accompanied by required number of unsigned counterparts of Agreement with the other Contract Documents identified in Agreement and attached thereto.
Within 10 days thereafter, Successful Proposer shall sign and deliver required number of counterparts of Agreement and attached documents to Buyer. Within 10 days thereafter, Buyer shall deliver one fully signed counterpart to Successful Proposer.

28. CONTRACT TO BE ASSIGNED.

28.1. Proposer's attention is directed to provisions of Paragraph 12.2 of the Agreement which provides for assignment of the Contract to a construction contractor designated by Buyer to construct the San Luis Obispo Water Resource Recovery Facility. Proposer should consider the application of the terms and conditions of the Contract Documents after assignment, and is advised of the duty to continue to perform the Contract after it has been assigned to the construction contractor. Timing of assignment is set forth in Agreement. Forms documenting assignment of the Contract and for agreement of Seller's surety to such assignment are included as attachments to the Agreement.

END OF SECTION

RIGHT OF ENTRY AGREEMENT

This Right of Entry Agreement (**"Right of Entry"**) is entered into by the City of San Luis Obispo (**"Grantor"**) and _____ (**"Grantee"**). Grantor and Grantee are sometimes individually referred to as **"Party"** and collectively as **"Parties."**

RECITALS

A. Grantor is the owner of certain real property located at _____(the **"Site"**).

B. Grantee desires to obtain Grantor's permission to enter onto the Site, on a temporary basis, for the limited purpose of examining the Site, including any permitted inspections and testing, in order to submit a bid on the City of San Luis Obispo's Water Resource Recovery Facility Membrane Equipment System project.

C. The Parties wish to enter into this Right of Entry whereby Grantor will allow Grantee to enter onto the Site, on a temporary basis, for the above stated purpose.

NOW, THEREFORE, Grantor and Grantee do hereby agree as follows:

AGREEMENT

1. Right of Entry. Grantor hereby grants to Grantee, its agents, employees and contractors the temporary non-exclusive right to enter onto the Site for the purposes described in Recital B above; provided, however, that Grantee's use of the Site permitted hereunder shall not interfere with the safe operation and use of the Site by Grantor; and provided further that all persons who enter upon the Site pursuant to this Right of Entry do so at their own risk and shall comply with any and all instructions and directions of Grantor.

2. Term. This Right of Entry will be effective between _____; provided, however, that it is anticipated that actual entry upon the Site will occur only on one day. Pursuant to the notice provisions of Section 3 below, Grantee will notify Grantor regarding the date of intended entry.

3. Notice. Grantee shall provide not less than twenty-four (24) hours prior notice to Grantor prior to entering the Site. Such notice may be provided by telephone, at Grantor's phone number as listed below:

Dave Hix (805) 781-7039

4. Restoration of Site. Upon completion of any activities on the Site, Grantee shall, at its sole cost and expense, restore the Site to the condition in which it existed immediately prior to Grantee's entry onto the Site. Should Grantee fail to comply with this obligation following notice from Grantor, Grantor shall have the right to restore the Site and recover its costs from Grantee.

5. Indemnification and Defense; Insurance.

A. Grantee hereby agrees to indemnify, defend, assume all liability for and hold harmless Grantor and its officers, employees, agents and representatives, to the maximum extent allowed by law, from all actions, claims, suits, penalties, obligations, liabilities, damages to property, costs and expenses (including, without limitation, any fines, penalties, judgments, settlements, actual litigation expenses and experts' and actual attorneys' fees), environmental claims or bodily and/or personal injuries or death to any persons, arising out of or in any way connected to Grantee's, its agents' or its contractors' acts or omissions or willful misconduct related to entry onto or use of the Site pursuant to this Right of Entry. The obligations of this provision shall continue in effect until the Site is restored pursuant to Section 4 above, and shall apply regardless of whether such damage or claim shall accrue or be discovered before or after the termination of this Right of Entry.

B. Upon written notice from Grantor, Grantee agrees to assume the defense of any lawsuit, administrative action or other proceeding for which Grantee has an obligation to defend pursuant to Section 5(A) above.

C. The obligations under this Section 5 shall apply except to the extent of the sole negligence or willful misconduct of Grantor, and are in addition to any other rights or remedies under the law or under this Right of Entry. The obligations of this Section 5 shall survive revocation or termination of this Right of Entry.

D. Grantee shall ensure that it and all of its agents or contractors entering the Site maintain general commercial liability insurance in commercially reasonable amounts at all times during the term of this Right of Entry. Proof of such insurance shall be provided to Grantor upon request.

6. Authority to Enter Agreement. Grantor warrants that it is the owner of the Site and that the undersigned is authorized to grant permission to enter onto the Site for the use specified in this Right of Entry. Grantee hereby warrants that the undersigned is authorized to execute this Right of Entry on behalf of Grantee.

7. Entire Agreement. This Right of Entry is intended by the Parties as a full and final expression of their understanding with respect to the matters contained in this Right of Entry.

8. Amendment; Modification. No supplement, modification, or amendment of this Right of Entry shall be binding unless executed in writing and signed by both Parties.

9. Governing Law, Venue. This Right of Entry shall be governed by the laws of the State of California. Venue shall be in San Luis Obispo, California.

10. Counterparts. This Right of Entry may be executed in one or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the Parties hereto have executed this Right of Entry on the date as indicated beside each Party's signature.

Date: _____, 2017

GRANTOR:

CITY OF SAN LUIS OBISPO

_____

Date: _____, 2017

GRANTEE:

By: _____

[Signature Page to Right of Entry Agreement]

NOTE TO PROPOSER: Use ink for completing this Proposal Form.

PROPOSAL FORM

1. PROPOSAL RECIPIENT.

1.1. This Proposal is submitted to:

Buyer: City of San Luis Obispo

Address: 990 Palm Street, San Luis Obispo, CA 93401

Project: Procurement of a Membrane Equipment System for the San Luis Obispo Water Resource Recovery Facility

1.2. Undersigned Proposer proposes and agrees, if this Proposal is accepted, to enter into a Contract with Buyer in the form included in Proposal Documents to furnish Goods and Special Services as specified or indicated in Proposal Documents for the prices and within the times indicated in this Proposal and in accordance with other terms and conditions of Proposal Documents.

2. PROPOSER'S ACKNOWLEDGEMENTS.

2.1. Proposer accepts all of the terms and conditions of the all Proposal and Contract Documents, including without limitation those dealing with disposition of Proposal security. Proposal will remain subject to acceptance for 60 days after Proposal opening, or for such longer period of time that Bidder may agree to in writing upon request of Buyer.

2.2. Proposer accepts the provisions of the Agreement as to the assignment of the contract for furnishing Goods and Special Services.

3. PROPOSER'S REPRESENTATIONS.

3.1. In submitting this Proposal, Proposer represents that:

3.1.1. Proposer has examined and carefully studied Proposal Documents, related data identified in Proposal Documents, and the following Addenda, receipt of all of which is hereby acknowledged.

Addendum No.	Addendum Date

3.1.2. Proposer has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided and become familiar with and is satisfied as to the local conditions that may affect cost, progress, or furnishing of Goods and Special Services if required to do so by Proposal Documents, or if, in Proposer's judgment, any local condition may affect cost, progress, or the furnishing of Goods and Special Services.

3.1.3. Proposer is familiar with and is satisfied as to Laws and Regulations in effect as of the date of the Proposal that may affect cost, progress, and furnishing of Goods and Special Services.

3.1.4. Proposer has carefully studied and correlated information known to Proposer; information commonly known to Sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Proposer's visits, if any, to the Point of Destination and the site where the Goods will be installed or Special Services will be provided; and any reports and drawings identified in the Proposal Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under Proposal Documents.

3.1.5. Proposer has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Proposer has discovered in Proposal Documents, and written resolution thereof by Engineer is acceptable to Proposer.

3.1.6. Proposal Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services for which this Proposal is submitted.

4. PROPOSER'S CERTIFICATIONS.

4.1. Proposer certifies that:

4.1.1. This Proposal is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

4.1.2. Proposer has not directly or indirectly induced or solicited any other Proposer to submit a false or sham Proposal;

4.1.3. Proposer has not solicited or induced any individual or entity to refrain from proposing; and

4.1.4. Proposer has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.1.4:

4.1.4.1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the proposal process;

4.1.4.2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the proposal process to the detriment of Buyer, (b) to establish Proposal prices at artificial noncompetitive levels, or (c) to deprive Buyer of the benefits of free and open competition;

4.1.4.3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish Proposal prices at artificial, noncompetitive levels; and

4.1.4.4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the proposal process.

5. BASIS OF PROPOSAL.

5.1. Proposal Price: As provided in Proposal Schedule "A" Lifecycle Cost Evaluation Form, Item F.1.

5.2. Proposer will furnish the Goods and Special Services in accordance with the Contract Documents, including without limitation services, equipment, materials, transportation, insurance and taxes for the following price(s):

PROPOSAL PRICE_____ Dollars
(use words)

and _____ Cents $_____
(use words) (figures)

5.3. Discrepancies between words and figures will be resolved in favor of words.

5.4. Proposer shall provide required information by filling in all blanks on the Proposal Form and Proposal Schedules.

5.5. Proposer further acknowledges that quantities of unit price items are not guaranteed and final payment will be based on actual quantities, determined as provided in Proposal Documents.

6. TIME OF COMPLETION.

6.1. Proposer agrees that furnishing of Goods and Special Services will conform to schedule set forth in Agreement and in Section 01 29 00, Measurement and Payment.

6.2. Proposer accepts the provisions of the Agreement and Section 01 29 00, Measurement and Payment, as to liquidated damages.

7. ATTACHMENTS TO THIS PROPOSAL.

7.1. The following documents are attached to and made a condition of this Proposal:

7.1.1. Proposal Form.

7.1.2. Proposal Schedules “A” through “O”.

7.1.3. Proposal Bond or other Proposal Security.

7.1.4. Certificate of Proposer Regarding Equal Opportunity.

7.1.5. Evidence of authority to do business in the state of the Project.

7.1.6. Contractor’s License No.: _____.

7.1.7. Noncollusion Declaration.

7.1.8. Insurance Certificate.

8. DEFINED TERMS.

8.1. Terms used in this Proposal with initial capital letters have meanings stated in the Instructions to Proposers, General Conditions, and the Supplementary Conditions.

9. PROPOSAL SUBMISSION.

9.1. This Proposal submitted by:

An Individual

Name *(typed or printed)*: _____

By *(signature)*: _____

Doing Business As: _____

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

A Corporation

Corporation Name: _____

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title: _____ (CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

A Limited Liability Company (LLC)

LLC Name: _____

State in Which Organized: _____

By: _____
(Signature – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title: _____

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

A Joint Venture

First Joint Venture Name: _____ (SEAL)

By: _____
(Signature of joint venture partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title: _____

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

Second Joint Venture Name: _____ (SEAL)

By: _____
(Signature of joint venture partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title: _____

Business Address: _____

_____

Phone No.: _____ Facsimile: _____

E-mail Address: _____

California Contractor's License Number and License Class:_____

END OF SECTION

SCHEDULE "A" WORKSHEETS

Notes to Proposers: 1) Values provided on these worksheets shall be for all membrane trains in service (Duty or Standby).
2) Proposers shall fill in all blanks within each worksheet.
3) The costs for Schedule "A", Items D.1 through D.5, as calculated per these worksheets, shall be guaranteed by the Seller. The Buyer shall assess penalties as set forth in the Agreement if these guaranteed costs are not met.

Schedule "A": Item D.1 - Air Scour Costs Worksheet

ITEM	A	B	C	D	E	F	G
	MGD	%	scfm	psi	hp	kw-hr/yr	$
	Influent Flow Rate	% of Time Over 10 Year Life	Average Membrane Air Scour Rate (scfm)	Pressure of air scour supply (psi) above atmospheric pressure	Blower hp = ((C*0.289)*((((13.7+D)/13.7)^0.283)-1))	kw-hr/yr = 8760*0.7457*E*B	Air Scour Costs = F*($0.16/kwh)
1	1.0	10					
2	3.1	40					
3	6.0	40					
4	9.3	10					
						Guaranteed Annual Average Air Scour Costs (Sum of Rows 1 through 4)	

Enter this amount on Schedule "A", Item D.1

Standard Oxygen Transfer Efficiency of Membrane Air Scour System: _____ % = X

Schedule "A": Item D.2 - Process Air Credit Worksheet

ITEM	A	B	C	E
	MGD	%	$	$
	Influent Flow Rate	% of Time Over 10 Year Life	Air Scour Costs (column G from Air Scour Costs Worksheet)	Process Air Cost Credit = (X/25)*C
5	1.0	10		
6	3.1	40		
7	6.0	40		
8	9.3	10		
			Guaranteed Annual Power Cost Savings for Process Air Credit (Sum of Rows 5 through 8)	

Enter this amount on Schedule "A", Item D.2 (as a negative number)

SCHEDULE "A" WORKSHEETS

Notes to Proposers: 1) Values provided on these worksheets shall be for all membrane trains in service (Duty or Standby).
2) Proposers shall fill in all blanks within each worksheet.
3) The costs for Schedule "A", Items D.1 through D.5, as calculated per these worksheets, shall be guaranteed by the Seller. The Buyer shall assess penalties as set forth in the Agreement if these guaranteed costs are not met.

Schedule "A": Item D.3 - Permeate Pumping Costs Worksheet

ITEM	A	B	C	D	E	F	G	H
	MGD	%	gpm	ft	hp	%	kw-hr/yr	$
	Influent Flow Rate	% of Time Over 10 Year Life	Permeate production rate (gpm) See note 1	Permeate Suction Pumping Head (Hydraulic gradeline in membrane tank minus hydraulic gradeline at permeate pump suction, ft) plus 4 psi discharge head (See note 2)	Pumping hp = (CxD)/(3960)	Wire to Water Efficiency	kw-hr/yr = E*8760*0.7457*(B/F)	(G*$0.16/kwh)
9	1.0	10						
10	3.1	40						
11	6.0	40						
12	9.3	10						
						Guaranteed Annual Permeate Pumping Costs (Sum of Rows 9 through 12)		

Enter this amount on Schedule "A", Item D.3

Notes

1. Must include production plus backpulse
2. Assume 4 psi (9.2 ft) discharge head. Value to be confirmed during detailed design.

Schedule "A": Item D.4 - Annual Chemical Costs for Membrane CIP Process

ITEM		A	B	C	D
		%	gallons/year	$/gallon	$
13	Chemical for Membrane Cleaning (if applicable)	Concentration	Annual Use	Unit Cost	Annual Cost = B*C
14	Sodium Hypochlorite Solution (specify below)	12.5		$0.64	
15	Sodium Hydroxide (specify below)	25		$0.83	

SCHEDULE "A" WORKSHEETS

Notes to Proposers: 1) Values provided on these worksheets shall be for all membrane trains in service (Duty or Standby).
2) Proposers shall fill in all blanks within each worksheet.
3) The costs for Schedule "A", Items D.1 through D.5, as calculated per these worksheets, shall be guaranteed by the Seller. The Buyer shall assess penalties as set forth in the Agreement if these guaranteed costs are not met.

16	Citric Acid (specify below)	50		$1.50	
17	Sodium Bisulfite (specify below)	25		$0.85	
18	Proprietary cleaning (specify below)				
19	Others (specify below)				
	Total Annual Chemical Costs(Sum of Rows 13 through 19)				

Enter this amount on Schedule "A", Item D.4

Schedule "A": Item D.5 - Backpulse Pumping Costs Worksheet (Include all pumping during normal operation and cleaning cycles

ITEM	A	B	C	D	E	F	G	H	I
	MGD	%	gpm	ft	hp	%	%	kw-hr/yr	$
	Influent Flow Rate	% of Time Over 10 Year Life	Backpulse pumping	Backpulse Pumping Head	Pumping hp = (CxD)/(3960)	Wire to Water Efficiency	Fraction of a day in Operation	kw-hr/yr = E*G*8760*0.7457*(B/F)	(H*$0.16/kwh)
20	1.0	10				0.7			
21	3.1	40				0.7			
22	6.0	40				0.7			
23	9.3	10				0.7			
								Guaranteed Annual Backpulse Pumping Costs (Sum of Rows 20 through 23)	

SCHEDULE "A"
LIFECYCLE COST EVALUATION FORM*

Notes to Proposers: 1) Values provided on these worksheets shall be for all membrane trains in duty or standby operation, as required for the flow condition. Assume membrane trains always contain mixed liquor except during cleaning cycles.

Item		Description	Units	Proposed Costs	Calculation Instructions
A. Membrane Equipment System Costs					
A.1	Membrane Equipment System				
	A.1.1	Instrumentation	$, lump sum	*	Enter Proposer's Lump Sum Amount
	A.1.2	Large Membrane Subunits	$, lump sum	*	Enter Proposer's Lump Sum Amount
	A.1.3	All Pumps	$, lump sum	*	Enter Proposer's Lump Sum Amount
	A.1.4	Air Scour Blowers	$, lump sum	*	Enter Proposer's Lump Sum Amount
	A.1.5	Chemical Feed System	$, lump sum	*	Enter Proposer's Lump Sum Amount
	A.1.6	All Remaining Equipment	$, lump sum	*	Enter Proposer's Lump Sum Amount
A.2	Performance & Payment Bond		$, lump sum	*	Enter Proposer's Lump Sum Amount
A.3	Services During Design/After Contract Awarded		$, lump sum	*	Enter Proposer's Lump Sum Amount
A.4	Services During Construction/After Contract Assigned		$, lump sum	*	Enter Proposer's Lump Sum Amount
A.5	Services During Startup/Commissioning		$, lump sum	*	Enter Proposer's Lump Sum Amount
A.6	Overall Treatment Plan Integration Software and Integration Startup Services		$, lump sum	*	Enter Proposer's Lump Sum Amount
A.7	Fixed 7-year Membrane Repair and Replacement Warranty (for years 1-7)		$, lump sum	*	Enter amount as described in Schedule B, Item (b)
A.8	Allowance for Unforseen Design Changes and Scope Modifications		$, lump sum	$ 200,000.00	Enter Proposer's Lump Sum Amount
A.9	Spare Parts		$, lump sum	*	Include spare parts required by Section 43 32 56, paragraph 1.10
A.10	**Total Membrane Equipment System Costs (Proposal Price)**			*	Sum of costs for Items A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9
B. Costs by Others					
B.1	Membrane Basin		$, lump sum	*	Item C.4 multiplied by $3.10
B.2	**Total Costs by Others**				Item B.1
C. Design Factors					
C.1	Number of Discrete and Analog I/O points at system PLCs		Number	*	Enter number of I/O points proposed by Bidder
C.2	Number of Actuated Valves		Number	*	Enter number of actuated valves greater than 4 inches diameter
C.3	Number of Pumps		Number	*	Enter number of pumps with drive power > 25 hp
C.4	Volume of Mixed Liquor in Membrane Basin		Gallons (U.S.)	*	Enter total volume of mixed liquor
D. Annual Operations and Maintenance Costs					
D.1	Air Scour		$, annual cost	*	Enter Item D.1 from Worksheet
D.2	Process Air Credit		$, annual cost	*	Enter Item D.2 from Worksheet
D.3	Permeate Pumping		$, annual cost	*	Enter Item D.3 from Worksheet
D.4	Cleaning Chemical		$, annual cost	*	Enter Item D.4 from Worksheet
D.5	Backpulse Pumping Cost		$, annual cost	*	Enter Item D.5 from Worksheet

SCHEDULE "A"
LIFECYCLE COST EVALUATION FORM*

Notes to Proposers: 1) Values provided on these worksheets shall be for all membrane trains in duty or standby operation, as required for the flow condition. Assume membrane trains always contain mixed liquor except during cleaning cycles.

Item		Description	Units	Proposed Costs	Calculation Instructions
D.6	Membrane Equipment				
	D.6.1	Actuated Valves	$, annual cost	*	Item C.2 multiplied by $500
	D.6.2	PLC I/Os	$, annual cost	*	Item C.1 multiplied by $300
	D.6.3	Pumps	$, annual cost	*	Item C.3 multiplied by $500
D.7	**Total Annual Operations and Maintenance Cost**			*	Sum of costs for Items D.1, D.2, D.3, D.4, D.5, D.6
E. Annual Membrane Repair and Replacement Costs					
E.1	Membrane Repair and Replacement Warranty Cost including Service Contract (for years 8-10)		$, annual cost	*	Enter amount as described in Schedule B, Item (d)
E.2	Fixed 7-year Service Contract (for years 1-7)		$, annual cost	*	Enter amount as described in Schedule B, Item (e)
F. Lifecycle Cost					
F.1	Proposal Price		$	*	Item A.10
F.2	Costs by Others		$	*	Item B.2
F.3	Total Present Worth of Annual Operations and Maintenance Costs		$	*	Item D.7 multiplied by 7.722
F.4	Total Present Worth of Membrane Repair and Replacement Costs		$	*	Item E.1 multiplied by 1.935 + Items E.2 multiplied by 5.786
F.5	Total Present Worth Cost		$	*	Sum of costs for Items F.1, F.2, F.3, F.4

*Proposers to fill in

SCHEDULE "B"
WARRANTIES AND SERVICE CONTRACTS

(a) Proposer shall warranty the equipment as required in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor). Details and conditions of the warranty are to be provided with the Proposal. In addition to all warranties which may be provided by law, Supplier shall warranty that the equipment delivered shall, (a) be free from defect of material or workmanship and conform strictly to the Contract Documents.

(b) Proposer shall warranty the repair and replacement of all membranes for a fixed period of 7 years. The cost for the Proposer to provide the repair and replacement warranty for the fixed period shall be provided on Proposal Schedule "A", Item A.7. Warranty is to be for full cost, and not pro-rated. Membrane replacement shall be deemed necessary when the membrane performance cannot be restored to the design capacity and performance by chemical cleaning and backwashing within 10 days of the date Buyer gives Seller notice of the failure. The maximum number of recovery cleanings for each year shall not exceed four (comprised of one every 90 days).

(c) The current and future membrane replacement cost, or additional purchase, (f.o.b. San Luis Obispo, California) is based on the following:

(i) proprietary descriptor for small membrane subunit (e.g., Model No.) _____*.
(ii) proprietary descriptor for large membrane subunit (e.g., Model No.) _____*.
(iii) the current replacement cost for each of the above small membrane subunits $_____*.
(iv) the current replacement cost for each of the above large membrane subunits $_____*.
(v) country of origin _____*.
(vi) the Proposer shall guarantee the membrane replacement cost per small and large membrane subunit will not increase at a rate greater than that given by the PPI "Other Commercial and Service Machinery manufacturing (NAICS No. 333319)" in the U.S. for a period not less than 10 years.

(d) The annual cost for the Proposer to provide a large membrane subunit repair and replacement contract for the repair and replacement of all membranes, as required, to maintain the equipment at its design capacity and performance, and to provide a service contract for the review and maintenance of the membrane and process system shall be provided on Proposal Schedule "A", Item E.1. The annual payment for these contracts shall commence at the beginning of year 8 and continue to the end of year 10. This annual cost shall be a fixed cost per year from year 8 to end of year 10 and shall not be subject to PPI "Other Commercial and Service Machinery manufacturing (NAICS No. 333319)" escalation. The cost of the repair and

replacement contract shall include a minimum of one annual site visit of at least 2 days in duration. The Site visit shall include membrane material (i.e., fiber) analysis of at least 10 percent of all installed membrane fibers.

(e) The cost for the Proposer to provide a service contract for the review and maintenance of the membrane and process system, for the fixed period of time shown in Item (b) shall be provided on Proposal Schedule “A”, Item E.2. Details and conditions of the service contract, including a membrane fiber analysis minimum each 6 months and minimum annual site visit, and telephone support, are to be provided with the Proposal.

*Proposers to fill in.

SCHEDULE "C"
TECHNICAL DATA FOR MEMBRANE EQUIPMENT SYSTEM

Submit the following technical details of the Membrane Equipment System with the Proposal. Provide catalog information for all mechanical components of the Membrane Equipment System including pumps, membrane air scour blowers, valves, and piping. Attach any other pertinent details to this Schedule, as required.

Provide documentation from the California Department of Public Health (CDPH), Environmental Protection Agency (EPA)/National Sanitation Foundation (NSF) – Environmental Technology Verification (ETV) for the membrane certification or approval by CDPH for Title 22 compliance.

1. Membrane Subunits*

Membrane Material	_____
Membrane Type (e.g., Hollow Fiber)	_____
Manufacturer's designation of large membrane subunit (e.g., cassette, rack)	_____
Manufacturer's designation of small membrane subunit (e.g., module, cartridge)	_____
Proprietary Descriptor for large membrane subunit (e.g., Model No.)	_____
Pore Size (microns)	
Nominal	_____
Absolute	_____
Acceptable pH range during normal operation	_____
Acceptable pH range during cleaning	_____
Allowable Chlorine exposure (maximum ppm hours/year)	
Free Chlorine	_____
Combined (chloramines)	_____
Allowable exposure to Chlorine substitute	
Membrane Outer Surface Area (per small membrane subunit) (ft^2)	_____
Maximum weight of complete large membrane subunit (lbs)	
Dry	_____
Wet	_____
Transmembrane Pressure (psig)	
Typical Range	_____
Maximum	_____

2. Membrane Configuration*

Number of independent and isolatable membrane trains _____
Number of large membrane subunits per train _____
Number of small membrane subunits per large membrane subunit _____
Spaces in each large membrane subunit for additional small membrane subunits _____
Inside length of each membrane basin including spare slots (ft) _____
Inside width of each membrane basin including spare slots (ft) _____
Sidewall depth of each membrane basin (to top of concrete) (ft) _____
Minimum sidewater depth of each membrane basin (ft) _____

Permeate Cycle

Is backwash used as part of permeate cycle? (yes/no) _____
Is relax used as part of permeate cycle? (yes/no) _____
Length of permeate cycle (including backwash and/or relax) (minutes) _____
Backwash Interval (if applicable) (minutes) _____
Backwash Duration (if applicable) (minutes) _____
Relax Interval (if applicable) (minutes) _____
Relax Duration (if applicable) (minutes) _____
Source of backwash water (e.g., permeate) _____
Chemical(s) added to backwash water during normal operation _____

Air Scour

Instantaneous air flow rate to each membrane train during air scour with membranes installed as per Proposal (scfm) _____
Instantaneous air flow rate to each membrane train during air scour when all membrane spaces filled (scfm) _____
Time per year that a membrane train requires aeration, assuming that other than maintenance cleans and recovery cleans, train in continuous service 24 hours per day, 365 days per year – provide details of how this number was calculated (hours per year) _____
How frequently does a standby train, filled with mixed liquor, need to be aerated?
(i.e., every X minutes)
Length of time a standby train needs to be aerated (seconds)
Instantaneous air flow rate to a standby train for agitation/mixing (scfm)
When a train is out of service, filled with water, for an extended period of time, does it need to be aerated for agitation/mixing? (yes/no) _____
How frequently does an out of service train need to be aerated? (i.e., every X minutes) _____
Length of time an out of service train needs to be aerated (seconds) _____

Instantaneous air flow rate to an out of service train for agitation/mixing (scfm) _____

Aerator Flush

Is aerator flush required? (yes/no) _____
Number of aerator flushes per day _____
Duration of each aerator flush _____

Membrane Feed Flow (Mixed Liquor Feed Pumps supplied by others)

Does Proposer's system include a distribution system to distribute mixed liquor within each membrane tank? (yes/no) _____
Head loss through mixed liquor distribution system to each membrane tank (psi) (if applicable) _____
Minimum mixed liquor flow rate per membrane train (if applicable) _____

Primary Effluent Fine Screens (supplied by others) _____
Acceptable fine screen types (Drum, Band, etc.) _____
Maximum allowable opening size (mm) _____

3. Pumps*

Note: Use as many of these sheets as necessary for each type of pump offered.

Application (e.g., Permeate, Backpulse, etc.)			
Number of Pumps Required (e.g., 2 duty, 1 standby)			
Pump Manufacturer/ Model Number			
Pump Type (attach catalog cut)			
Flow Range (gpm) (attach pump curve)			
TDH (ft)			
Speed of Drive (rpm)			
Motor Type			
Motor HP			
Power Supply (Volts/Phases/Hertz)			

Estimated Noise Level at 1 meter installed (maximum 80 dBA)			
Efficiency (high, %)			
Coupling Type and Material			
Materials of Construction			

4. Compressed Air Equipment (if applicable)*

Application (e.g., instrumentation) _____

Compressor Type (e.g., centrifugal) _____

Number Required (note: 1 standby required) _____

Manufacturer/Model Number _____

Flow rate and Pressure _____

Speed of Drive (rpm) _____

Materials of Construction _____

Rating and Manufacturer of Motors (hp) _____

Power Supply (Volts/Phases/Hertz) _____

Estimated Noise Level at 1 meter installed _____

Control Panel included? (yes/no) _____

Control Panel integral to unit? (yes/no) _____

Air Receiver Volume (ft^3) (if applicable) _____

Air Receiver Dimensions (ft) (if applicable) _____

5. Air Scour Equipment*

Application (e.g., membrane clean) _____

Blower Type (e.g., positive displacement hybrid) _____

Number Required (note: 1 standby required) _____

Manufacturer/Model Number _____

Flow rate and Pressure _____

Speed of Drive (rpm), or adjustable speed _____

Materials of Construction _____

Rating and Manufacturer of Motors (hp)	
Power Supply (Volts/Phases/Hertz)	
Estimated Noise Level at 1 meter installed	
Control Panel included? (yes/no)	
Control Panel integral to unit? (yes/no)	

SCHEDULE "D"

SCOPE OF SUPPLY

The Seller shall provide the following scope of supply information in a tabular format, complete with all mechanical, electrical and control system components and items to be provided with the proposed membrane equipment system. Failure to provide a complete list, including all mechanical, electrical, and control system equipment and materials to be provided, all control system components described and all electrical load information and items as indicated below will result in the proposal being considered nonresponsive.

(a) Provide a detailed bill of materials including manufacturers, model numbers, and materials of construction for all major equipment including pumps, motors, PLC, instruments, devices, etc.
(b) Provide the total connected electrical load in kW, kVA, and amperes for the MES including all ancillary equipment furnished by the Seller. Load information for each individual item and total connected load shall be provided on the detailed bill of materials table. The information shall be complete and consistently provided for each item of equipment.
(c) List all three-phase and single-phase electrical components, their horsepower rating or load, in amperes and voltage. Separately list any DC operated equipment and their load in volts and amps.
(d) List components that will run off power supply other than 480V, three-phase.

SCHEDULE "E"

DRAWINGS

(a) Attach the following Drawings at a minimum to this Schedule. Clearly delineate between Proposer and Contractor scope of supply.

- General arrangement drawings of large membrane subunits including critical dimensions to allow commencement of detailed design. Clearly show drawing scale, all pipe, valves, and fittings being supplied by the Seller and the pipe, valves and fitting to be supplied by the Contractor. Show all mechanical and electrical connection points.
- Process and instrumentation diagrams (P&IDs) for the proposed Membrane Equipment System including equipment, the clean in-place systems, air systems, backwash systems, neutralization systems, chemical feed systems, and sampling systems.
- Plan layout and dimensions of membrane tanks and all ancillary equipment for the proposed Membrane Equipment System. Provide accurate operating volumes and dimensions required for any tanks associated with the MES (i.e., membrane tanks, backwash tank, CIP tank, etc.).
- Cross sections of membrane tanks and all ancillary equipment.
- All other Drawings required by the Specifications.

SCHEDULE "F"

PRODUCTION CAPACITY

Supplier to fill in the design net flux rates (gal/d/ft^2) under the following flow conditions and minimum temperature of 16 degrees C. Assume Out of Service train is not available for cleaning cycles.

Flow Condition and Duration	Flow	Flux with All Trains In Service	Flux with One Train Out of Service
Minimum Month Average Day	2.3 mgd	*	*
Annual Average Day	6.3 mgd	*	*
Maximum Equalized Flow (for 4 consecutive days)	13.2 mgd	*	*

*Suppliers to fill in

Will the contractual flow/duration performance of the membranes be restored by chemical cleaning regardless of any prior flow/duration events that may have exceeded one or more of the defined conditions? YES _____* NO _____* (If no, attach explanation to this schedule.)

What is the maximum flow that could be treated by the facility for two continuous hours under the following conditions:

(a) All trains operating with proposed number of membrane units and proposed equipment _____*.

(b) All trains operating with all membrane spaces filled using proposed equipment _____*.

(c) Specify if flows higher than those specified in (b) can be exceeded if equipment is upsized, and describe what equipment would need to be modified to increase the capacity _____*.

Provide contact information for a minimum of two full scale installations where these fluxes, after temperature adjustment, have been previously demonstrated for a period of at least 200 days. Provide graphs of flux versus time, noting the temperature and MLSS concentration. Provide information in the following table, using one sheet for each reference installation.

Flux Reference 1*

Plant Name	
Location (City, State, Country)	
Contact	
Name	
Phone	
Fax	
e-mail	
Date of Commissioning	
Average Annual Flow (mgd)	
Average Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Month Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Day Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Peak Hour Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Minimum Wastewater Temperature (°F)	
Average MLSS Concentration in Membrane Tanks (mg/L)	

*Suppliers to fill in

Flux Reference 2*

Plant Name	
Location (City, State, Country)	
Contact	
Name	
Phone	
Fax	
e-mail	
Date of Commissioning	
Average Annual Flow (mgd)	
Average Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Month Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Day Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Peak Hour Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Minimum Wastewater Temperature (°F)	
Average MLSS Concentration in Membrane Tanks (mg/L)	

*Suppliers to fill in

Flux Reference 3*

Plant Name	
Location (City, State, Country)	
Contact	
Name	
Phone	
Fax	
e-mail	
Date of Commissioning	
Average Annual Flow (mgd)	
Average Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Month Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Max Day Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Peak Hour Flux (gfd)/Temp (°F)/MLSS (mg/L)	/ /
Minimum Wastewater Temperature (°F)	
Average MLSS Concentration in Membrane Tanks (mg/L)	

*Suppliers to fill in

SCHEDULE "G"

SUPERVISION OF INSTALLATION AND PERFORMANCE TESTING, OPERATOR TRAINING AND MAINTENANCE INSTRUCTIONS*

Supplier shall include services, including time onsite and travel expenses for supervision of installation and performance testing, operator training and maintenance instruction as specified in Section 01 43 34, Special Services, Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), Section 40 99 90, Package Control Systems, Section 43 12 01, Compressed Air Systems, Section 44 42 19.04, Rotary Positive Displacement Blower, Section 44 42 56.10, Horizontal End Suction Centrifugal Pumps, and Section 44 42 56.14, Lobe Pumps. For services specified as full time such as ORT and PAT and control system testing, supplier shall include labor and travel for the duration of these activities.

(a) The price for supervision of installation and commissioning includes for _____* person-days onsite in _____* separate trips and shall include for attendance at a 1 day predelivery site meeting with the Contractor and Owner. The rate per person-day for supervision of installation and commissioning is $_____*.

(b) The price for operator training and maintenance instructions for the Owner and Contractor includes for _____* person-days onsite in _____* separate trips and shall include for attendance at a 1 day precommissioning site meeting with the Contractor and Owner and a 2 day review of operations at the end of the 1 year maintenance period. The rate per person-day for operator training and maintenance instructions is $_____*.

(c) The rate for each trip (included or additional) is _____*.

* Suppliers shall fill in all person-days.

SCHEDULE "H"

SPECIAL TOOLS AND SPARE PARTS LIST*

The Supplier will provide special tools and spare parts specified in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor). The total cost of these tools and parts costs is included in the Proposal Price on Line A.9 of Schedule A.

TABLE H-1*
RECOMMENDED SPECIAL TOOLS AND SPARE PARTS LIST

Quantity	Item	Unit Price	Total Price

(Supplier may attach separate page to this Schedule if more space is required)

* Suppliers to fill in

SCHEDULE "I"

O&M CONSIDERATIONS*

The Supplier is to provide the following information in sufficient detail for the Engineer to be able to fully evaluate the proposed equipment. Supplier may provide additional information as necessary to provide the information requested.

1. **System Configuration**. Describe the configuration of the proposed system including, but not limited to, the standardization of the products used and future availability of spare parts, and the integration of the functionality of the various components.

2. **Instrumentation and Control**. Describe instrumentation and control system including software, hardware, control features, remote system monitoring, membrane integrity, data storage, and alarms.

3. **Membrane Maintenance**. Describe the various operating procedures that allow the system to sustain design flux rates. Include descriptions of backwash, relax, air scour, maintenance clean, and recovery clean as applicable for trains in service, in standby, or out of service. Describe how the trains need to be controlled to match the flow fluctuations at the WRRF and maintain flow to the UV disinfection process. Describe how operation changes seasonally as the temperature changes. Suppliers to fill in the information regarding maintenance and recovery cleans in Table I-1.

TABLE I-1*
MEMBRANE MAINTENANCE

Parameter	Maintenance Clean	Recovery Clean/CIP	Other
Identify membrane cleaning strategy(ies) used (yes/no)			
Fully automated (yes/no)			
Interval between cleaning cycles (minutes, hours, days)			
Cleaning cycle duration			
Instantaneous air scour requirement (scfm)			
Source of backwash water (if different from permeate)			

TABLE I-1* MEMBRANE MAINTENANCE			
Parameter	**Maintenance Clean**	**Recovery Clean/CIP**	**Other**
Will the source water be heated for maintenance cleans? If so, to what temperature?			
Chemicals added and concentration (w/w) (list all applicable)			
Chlorine alternative (at Buyer's option), list chemical and concentration			
What membrane grouping is independently cleaned (e.g., cassette, train)?			
How long is train out of service (minutes, hours, days)			
Is draining membrane tank required (yes/no)			
Volume of spent cleaning solution per maintenance clean (gallons/train)			

* Suppliers to fill in

4. **Maintainability and Operability**. Suppliers to provide estimate of labor and maintenance hours for the proposed facility in Table I-2. If specific activities are not applicable to the Supplier's proposed system, indicate this in the table. In addition to the table, provide a brief description of the routine activities required and the time required by operators to perform such activities. Describe routine activities associated with common equipment systems such as air extraction systems, air blowers, or other systems. Describe the frequency and need for membrane removal by hoisting system. Describe how membrane integrity is tested and failed fibers are identified.

5. **Technical Support**. Identify and describe the manner in which technical support will be provided during system operation. Identify the location, size, staff complement and capacity of technical support, assembly, and parts storage facilities that will be utilized after commissioning of the systems.

TABLE I-2* LABOR AND MAINTENANCE ESTIMATES**		
Activity	**Time Required by Plant Operator (hours/year)**	**Time Required by Plant Maintenance Staff (hours/year)**
Inspection of membranes		
Inspection of hoses and fittings		
Maintenance Cleaning		
Recovery Cleaning		
Permeate Pump Maintenance		
Chemical Pumps Maintenance		
Membrane Scour Blowers Maintenance		
Air Compressors Maintenance		
Automated Valves Maintenance		
Total (hours/year):		

* Suppliers to fill in

** This table represents the Supplier's best estimates based on previous experience at similar facilities. This table is not intended to represent the total staffing requirements for the plant. These hours do not include maintenance and operation of biological process, headworks, solids handling, etc.

SCHEDULE "J"

PROJECT IMPLEMENTATION

The Supplier is to provide the following information in sufficient detail for the Engineer to be able to fully evaluate the proposed equipment. Supplier may provide additional information as necessary to provide the information requested.

1. **Project Team**.

    - Describe the proposed approach to the overall management of this Project.
    - Identify key team members, roles of those members, and experience of key team members including design, manufacturing, construction, training and service team members.
    - Provide resume and contact information for the **Project Manager** for this Project.

        Name _____ *
        Address _____ *
        Phone _____ *
        Fax _____ *
        Email _____ *

    - Provide contact information for the **Membrane System Integrator** for this project. It is anticipated that the integrator will be familiar with the functionality, design, customization, and performance of all parts of the membrane system and will be responsible for ensuring that the overall system functions as intended. The integrator will work closely with the Project Manager, who will retain primary responsibility for project communications, scheduling, budget control, team management, and procurement.

        Name _____ *
        Address _____ *
        Phone _____ *
        Fax _____ *
        Email _____ *

    - Identify the depth of resources available should a team member no longer be available.
    - Confirm that the team members proposed will not be changed without the consent of the Owner.

* Suppliers to fill in

2. **Design Approach**.

Provide a description of project approach to completion of the design, manufacturing, startup and training, and service for the membrane system provided. Supplier shall provide a reasonable amount of detail on all of the items which follow so as to provide clear and concise data to determine that the Supplier's project approach is sound and meets with the Owner's requirements. Supplier must understand that quality in both manufacturing and installation, the thoroughness of the design, Operation and Maintenance, and Standard Operating Procedures are of prime importance to the Owner and Contractor. The project approach shall incorporate these requirements. This approach to the Project shall be detailed and shall include the following:

- How the team will approach the design of the project, and how they will interface with Engineer, Contractor, and Owner.
- How team will proceed with the system manufacturing, and how Engineer and Owner can or should be a part of that process.
- How the project will be scheduled to meet Contractor and Owner requirements. Identify the locations of all proposed or required meetings and technical review sessions.
- How the team will interface with the Engineer, Contractor, and Owner during construction.
- How the team will interface with Engineer, Contractor, Owner, and Contractor for automation and controls, including design, coordination and integration work of Process Instrumentation and Control System Contractor.
- Methodology for startup of system including interface with Engineer, Contractor, Owner.
- Methodology of training of Owner personnel including interface with Engineer and Contractor.
- Methodology for establishment and communication of Standard Operating Procedures for system.
- Methodology for establishment and communication of Operation and Maintenance requirements for the system.
- Procedure for obtaining warranty service of membrane equipment system during warranty period including lead time and parts inventory and location.
- Procedure for obtaining service of membrane equipment system after warranty period including lead time and parts inventory and location.
- Any other information that will set your team and organization apart from any other membrane equipment system provider.

3. **Systems Integration**.

During the execution of the project, describe what measures will be taken to ensure that the system design is integrated, will function as intended, and that customized portions of the system will be reliable and functional.

4. **Quality Assurance**.

Describe how the QA program will be provided internally and how “What if” scenarios will be developed and assessed during the system development and design stages. (Note: “What if” scenarios include the system response to failure of any specific element, and/or power disruptions, etc.)

5. **Completeness and Clarity**.

Proposal submission will be evaluated with the understanding that it will be representative of the types of submittals to be provided during the course of the project. Describe what measures will be taken to ensure that all communications are technically complete, accurate and clear.

SCHEDULE "K"

MBR EXPERIENCE

The Supplier is to provide the following information in sufficient detail for the Engineer to be able to fully evaluate the proposed equipment. Supplier may provide additional information as necessary to explain the requested information.

1. **Representative installations meeting the qualifications and experience requirements as stated in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor)**.

   Provide the location, size, and startup dates of five representative installations of the proposed equipment in a MBR application fulfilling the qualifications experience requirements as stated in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor). Include information regarding plant effluent, effluent criteria, and whether the facility is achieving its effluent and flow criteria. Provide names and contact information, including telephone numbers, of the client and general contractor.

   A. Supplier shall provide the following information for each representative installation. Data shall be provided in the form of plots of each specified parameter as a function of calendar time ***for each membrane train*** from the beginning of train operation until date of Proposal submittal.

      1. Design mixed liquor suspended solids (MLSS) concentration and actual operating MLSS.
      2. Mixed liquor (or membrane filtrate) temperature.
      3. Design filtrate flow and actual operating filtrate flow.
      4. Design flux rate and actual operating flux rate.
      5. Transmembrane pressure.
      6. Temperature corrected permeability.
      7. Filtrate turbidity.

   B. Supplier shall also provide the following information for each representative installation:

      1. Frequency of hypochlorite maintenance cleans.
      2. Target hypochlorite concentration in maintenance clean solution.
      3. Frequency of hypochlorite recovery cleans.
      4. Target hypochlorite concentration in recovery clean solution.
      5. Frequency of acid maintenance cleans and recovery cleans.
      6. Target pH (or acid concentration) in recovery clean solution.
      7. Date at which a module or modules were replaced and location(s) within membrane train/cassette.

8. Date of module installation and date of initial operation (for each replacement module).
9. Cause(s) of replacement (e.g., insufficient train production or permeability, inadequate filtrate quality, excessive fiber pinning).

2. **Installations with 7 Years' Operation**

Provide the location, size, and startup dates of five representative installations of the proposed equipment in a MBR application that have been in operation for 7 years. Include information regarding plant performance, effluent criteria, and whether the facility is meeting the effluent criteria. Provide names and contact information, including telephone numbers, of the client and general contractor.

A. Supplier shall provide the following information for each representative installation. Data shall be provided in the form of plots of each specified parameter as a function of calendar time ***for each membrane train*** from the beginning of train operation until date of Proposal submittal.

1. Design filtrate flow and actual filtrate flow.
2. Design filtrate turbidity and actual filtrate turbidity.
3. Date at which a module or modules were replaced and location(s) within membrane train/cassette.
4. Date of module installation and date of initial operation (for each replacement module).
5. Cause(s) of replacement (e.g. insufficient train production or permeability, inadequate filtrate quality, excessive fiber pinning).

3. **List of MBR Facilities Requiring Membrane Replacement During Warranty Period**

Provide a list of all facilities which have required membrane replacement during the membrane warranty period and the reason for membrane replacement.

SCHEDULE "L"

CORPORATE RESPONSIBILITY

The Supplier is to provide the following information in sufficient detail for the Engineer to be able to fully evaluate the proposed equipment. Supplier may provide additional information as necessary to provide the information requested.

1. **Southwest Presence**.

   Describe your resources and commitments in the Southwest (California, Arizona, and Nevada), including relationships and joint ventures with key partners or affiliated companies. Describe where the engineering and technical design of the system will take place, including the technical staff size at each location. Describe where the system components will be manufactured and assembled.

2. **Corporate Financial Strength**.

   Provide financial information to demonstrate the stability and strength of the corporation. Identify whether any or all contractual commitments will be guaranteed by a parent corporation. (Note that all responses to this question must be with respect to the proposing entity only, and not to an affiliated or parent corporation.)

3. **Bonding Capability**.

   Demonstrate that the corporation will be fully bonded for this contract. Provide total bonding capacity and available bonding capacity. (Note that all responses to this question must be with respect to the proposing entity only, and not to an affiliated or parent corporation.)

4. **Surviving Manufacturer Agreement.**

   If for some reason the proposing corporation stops production of the membrane products and/or the membrane system components, identify any agreements in place that would allow another corporation the right to manufacture the membrane products or components.

SCHEDULE "M"

PERFORMANCE REQUIREMENTS*

Confirm that the system will meet all performance requirements as specified. Supplier may provide additional information as necessary to provide the information requested.

Will guarantee Design Production Capacity (yes/no) _____*

Will meet guaranteed Cleaning Requirements (yes/no) _____*

Will guarantee Permeate Quality (yes/no) _____*

Will obtain certification or approval required by California Department of Public Health for Title 22 compliance (yes/no) _____*

* Suppliers to fill in

PROPOSAL SCHEDULE "N"
BASELINE WATER QUALITY CONDITIONS

The following parameters will be measured following the initial commissioning of the system and will be measured thereafter on an occasional basis. It is intended that the measured parameters represent conditions that could affect the membrane system performance if the conditions change from the design condition. The Seller shall list any additional parameters to be included and indicate whether each is suggested or required. Listing additional parameters does not affect Seller's obligations regarding performance of the membrane system under the Contract Documents.

Primary Effluent:

1. BOD.
2. Ammonia.
3. pH.
4. Alkalinity.
5. Other.

PROPOSAL SCHEDULE "O"
ADDITIONAL FORMS REQUIRED TO BE SUBMITTED WITH PROPOSAL

The following forms included as part of this Schedule "O" or otherwise referenced herein must be submitted with the Proposal:

1. American Iron and Steel Certification;

2. Subcontractor's List;

3. Debarment and Suspension Certification

4. DIR Registration Certification (for Proposer and all subcontractors completing prevailing wage work);

5. Iran Contracting Act Certification;

6. Non-Collusion Declaration; and

7. DBE Forms 4500-3 and 4500-4 (Forms located in Exhibit 2 to SRF Requirements)

AMERICAN IRON AND STEEL CERTIFICATION

1. Identification of American-made Iron and Steel Products: The Proposer certifies that this Proposal reflects the Proposer's best, good faith effort to identify domestic sources of iron and steel products for every component contained in the proposal solicitation where such American-made components are required. The term ‘‘iron and steel products’’ means the following products made primarily of iron or steel - lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

2. Verification of U.S. Production: If this proposal is accepted, the Proposer agrees that it will provide, to the City, reasonable, sufficient, and timely verification of the U.S. production of each Iron and Steel Product incorporated into the Project.

3. Documentation Regarding Non-American-made Iron and Steel: The Proposer certifies that for any Iron or Steel Product that is not American-made but was incorporated in the development of this proposal, is allowed by waiver of the U.S. Environmental Protection Agency and such waiver is attached to this certification.

4. Warranty of Proposer: The Proposer hereby represents and warrants to and for the benefit of the City that (a) Proposer has reviewed and understands the American Iron and Steel Requirement, and (b) if the proposal is selected, all of the iron and steel products used in the project will be produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is attached to this certification.

_____
Signature

_____
Date

_____
Name and Title of Signer (Please Print)

Q & A’s, Waiver request instructions, and a list of approved waivers can be found at **http://water.epa.gov/grants_funding/aisrequirement.cfm**

SUBCONTRACTOR'S LIST

Supplier is required to provide the following information for all DBE and non-DBE subcontractors, who provided a proposal or were contacted by Supplier. This information must be submitted with the proposal.

Prime Contractor: _____

Project: _____

Firm Name: _____ Phone: _____

Business Address: _____ Fax: _____

Email: _____

License No.
and Classification: _____ Years in Business: _____

Contact Person: _____

Is the firm currently certified as a DBE? ☐ No ☐ Yes Cert. Number:_____

Type of work/ services/ materials proposed by proposer's subconsultant:

_____

_____

Amount of Quote: _____

Date of Quote: _____

DEBARMENT AND SUSPENSION CERTIFICATION

CONTRACTORS, SUBCONTRACTORS, DEBARMENT AND SUSPENSION. Executive Order 12549; 2 CFR Part 180; 2 CFR Part 1532. Supplier shall not subcontract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549, "Debarment and Suspension". Supplier shall not subcontract with any individual or organization on USEPA's List of Violating Facilities. (40 CFR, Part 31.35, Gov. Code 4477).

Supplier certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any federal department or agency;

(b) Have not within a three (3) year period preceding this Agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and

(d) Have not within a three (3) year period preceding this application/proposal had one or more public transactions (federal, state or local) terminated for cause or default.

Suspension and debarment information can be accessed at http://www.sam.gov. Supplier represents and warrants that it has or will include a term or conditions requiring compliance with this provision in all of its contracts and subcontracts entered into pursuant to this Agreement. Supplier acknowledges that failing to disclose the information as required at 2 CFR 180.335 may result in the termination, delay or negation of the Contract, or pursuance of legal remedies, including suspension and debarment.

Name of Proposer_____

Signature_____

Name_____

Title_____

Dated_____

DIR REGISTRATION CERTIFICATION

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to propose on, be listed in a proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. See http://www.dir.ca.gov/Public-Works/PublicWorks.html for additional information.

This DIR registration certification requirement applies to Proposer and any subcontractor of proposer who will perform work that is subject to the prevailing wage requirements under the Labor Code.

No proposal will be accepted nor any contract entered into without proof of the contractor's and applicable subcontractors' current registration with the Department of Industrial Relations to perform public work.

Proposer hereby certifies that it is aware of the registration requirements set forth in Labor Code sections 1725.5 and 1771.1 and is currently registered as a contractor with the Department of Industrial Relations.

Name of Proposer:_____

DIR Registration Number:_____

Proposer further acknowledges:

Proposer shall maintain a current DIR registration for the duration of the project.

Proposer shall include the requirements of Labor Code sections 1725.5 and 1771.1 in its contract with subcontractors and ensure that all subcontractors are registered at the time of proposal opening and maintain registration status for the duration of the project.

Failure to submit this form or comply with any of the above requirements may result in a finding that the proposal is non-responsive.

Name of Proposer_____

Signature_____

Name_____

Title_____

Dated_____

END OF PUBLIC WORKS CONTRACTOR REGISTRATION CERTIFICATION

IRAN CONTRACTING ACT CERTIFICATION

(Public Contract Code Section 2200 et seq.)

As required by California Public Contract Code Section 2204, the Contractor certifies subject to penalty for perjury that the option checked below relating to the Contractor's status in regard to the Iran Contracting Act of 2010 (Public Contract Code Section 2200 et seq.) is true and correct:

☐ The Contractor is not:

(i) identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203; or

(ii) a financial institution that extends, for 45 days or more, credit in the amount of $20,000,000 or more to any other person or entity identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203, if that person or entity uses or will use the credit to provide goods or services in the energy sector in Iran.

☐ MRWPCA has exempted the Contractor from the requirements of the Iran Contracting Act of 2010 after making a public finding that, absent the exemption, MRWPCA will be unable to obtain the goods and/or services to be provided pursuant to the Contract.

☐ The amount of the Contract payable to the Contractor for the Project does not exceed $1,000,000.

Signed:_____

Titled:_____

Firm:_____

Date:_____

Note: In accordance with Public Contract Code Section 2205, false certification of this form shall be reported to the California Attorney General and may result in civil penalties equal to the greater of $250,000 or twice the Contract amount, termination of the Contract and/or ineligibility to propose on contracts for three years.

END OF IRAN CONTRACTING ACT CERTIFICATION

NONCOLLUSION DECLARATION

(To be executed prior to award)

UNITED STATES OF AMERICA)
) ss
STATE OF CALIFORNIA)

I, _____ of _____
(Firm Name)

being duly sworn, do depose and state: I, or the firm, association or corporation of which I am a member, a proposer on the Contract to be awarded by the City of San Luis Obispo for the construction of that certain construction project designated as:

MEMBRANE EQUIPMENT SYSTEM FOR THE CITY OF SAN LUIS OBISPO WATER RESOURCE RECOVERY FACILITY

located at San Luis Obispo, in the State of California, have not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive proposal in connection with such contract.

_____
Contractor

Subscribed and sworn to this _____day of _____, 2017.

_____
Notary Public

My Commission Expires: _____

END OF SECTION

PROPOSAL BOND

PROPOSER
(Name and Address):

_____

_____

_____

SURETY
(Name and Address of Principal Place of Business):

_____

_____

_____

BUYER (Name and Address):

_____

_____

_____

BOND:

Bond Number: _____

Penal Sum: _____

Date: _____
(Not later than Proposal due date)

PROPOSAL

Proposal Due Date: _____

Project (Brief Description Including Location):

_____

_____

_____

IN WITNESS WHEREOF, Surety and Proposer, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Proposal Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

PROPOSER

_____(Seal)
Bidder's Name and Corporate Seal

By: _____
Signature and Title

Attest: _____
Signature and Title

SURETY

_____(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, Buyer or other party shall be considered plural where applicable.

1. Proposer and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Buyer upon default of Bidder the penal sum set forth on the face of this Bond.

2. Default of Proposer shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Buyer) the executed Agreement required by the Bidding Documents and any performance and payment Bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1. Buyer accepts Proposer's Proposal and Proposer delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Buyer) the executed Agreement required by the Bidding Documents and any performance and payment Bonds required by the Bidding Documents, or

3.2. All Proposals are rejected by Buyer, or

3.3. Buyer fails to issue a Notice of Award to Proposer within the time specified in the Proposing Documents (or any extension thereof agreed to in writing by Buyer and, if applicable, consented to by Surety when required by paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Proposer and within 30 calendar days after receipt by Proposer and Surety of written notice of default from Buyer, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by the Buyer and Proposer, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Proposer and Surety and in no case later than one year after Proposal due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Proposer and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage prepaid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of and applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

DAVIS BACON WAGE RATE DETERMINATION

General Decision Number: CA170019 06/02/2017 CA19

Superseded General Decision Number: CA20160019

State: California

Construction Types: Building, Heavy (Heavy and Dredging) and Highway

County: San Luis Obispo County in California.

BUILDING, DREDGING (does not include hopper dredge work), HEAVY (does not include water well drilling, AND HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.20 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2017
1	01/20/2017
2	01/27/2017
3	02/17/2017
4	03/10/2017
5	04/07/2017
6	04/21/2017
7	05/12/2017
8	05/26/2017
9	06/02/2017

ASBE0005-002 07/04/2016

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems)	$ 38.37	20.13
Fire Stop Technician (Application of Firestopping Materials for wall openings and penetrations in walls, floors, ceilings and curtain walls)	$ 26.15	17.31

ASBE0005-004 07/04/2016

	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)	$ 18.38	10.82

BOIL0092-004 10/01/2012

Area within a 25 mile radius of City of Santa Maria

	Rates	Fringes

BOILERMAKER.....$ 41.17 28.27

BOIL0549-007 10/01/2016

Remainder of County outside a 25 mile radius of City of Santa Maria

	Rates	Fringes
BOILERMAKER	$ 39.68	35.71

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* BRCA0004-006 05/01/2017

	Rates	Fringes
BRICKLAYER; MARBLE SETTER	$ 38.69	14.45

*The wage scale for prevailing wage projects performed in Blythe, China lake, Death Valley, Fort Irwin, Twenty-Nine Palms, Needles and 1-15 corridor (Barstow to the Nevada State Line) will be Three Dollars ($3.00) above the standard San Bernardino/Riverside County hourly wage rate

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BRCA0018-008 06/01/2016

	Rates	Fringes
MARBLE FINISHER	$ 29.20	12.93
TILE FINISHER	$ 24.53	4.19

BRCA0018-011 06/01/2016

	Rates	Fringes
TILE LAYER	$ 35.89	16.24

CARP0409-001 07/01/2016

	Rates	Fringes
CARPENTER		
(1) Carpenter, Cabinet Installer, Insulation Installer, Hardwood Floor Worker and acoustical installer	$ 39.83	17.03
(2) Millwright	$ 40.90	17.03
(3) Piledrivermen/Derrick Bargeman, Bridge or Dock Carpenter, Heavy Framer, Rock Bargeman or Scowman, Rockslinger, Shingler (Commercial)	$ 40.53	17.03
(4) Pneumatic Nailer, Power Stapler	$ 40.09	17.03
(5) Sawfiler	$ 39.83	17.03
(6) Scaffold Builder	$ 31.60	17.03
(7) Table Power Saw Operator	$ 40.93	17.03

FOOTNOTE: Work of forming in the construction of open cut sewers or storm drains, on operations in which horizontal lagging is used in conjunction with steel H-Beams driven or placed in pre- drilled holes, for that portion of a lagged trench against which concrete is poured, namely, as a substitute for back forms (which work is performed by piledrivers): $0.13 per hour additional.

CARP0409-005 07/01/2015

	Rates	Fringes
Drywall		
DRYWALL INSTALLER/LATHER	$ 40.40	15.03
STOCKER/SCRAPPER	$ 10.00	7.17

CARP0409-008 08/01/2010

	Rates	Fringes
Modular Furniture Installer	$ 17.00	7.41

ELEC0639-001 01/01/2017

	Rates	Fringes
Electricians		
Wireman/Technician	$ 41.00	20.01

FOOTNOTES:

CABLE SPLICER: 10% additional per hour above Wireman/Technician basic hourly rate.

Work from trusses, swinging scaffolds, open ladders, scaffolds, bosun chairs, stacks or towers, where subject to a direct fall from the ground floor or support structure from a distance of fifty (50) feet to ninety (90) feet: to be paid time and one-half. Work from trusses, swinging scaffolds, open ladders, scaffolds, bosun chairs, stacks or towers, where subject to a direct fall from the ground floor or support structure from a distance over ninety (90) feet: to be paid double the regular straight time rate of pay. Where workers are required to work under compressed air or in areas where injurious gases, dust or fumes are present in amounts necessitating the use of gas masks or self-contained breathing apparatus (particle masks are not considered self-contained breathing apparatus) or where workers work on poles at a distance of seventy-five (75) feet or more from the ground: to be paid a bonus of straight time pay. This shall be at a minimum of one hour, and thereafter, each succeeding hour or fraction thereof shall constitute an hour at the bonus rate. Tunnel work: to be paid at the time and one-quarter hourly rate.

All employers may request workmen to report direct to a job within a free zone to include everything west of ten (10) miles east of Highway 101, as the crow flies, and then (10) miles north and south of Highway 46, as the crow flies, to the junction of Highway 41 and Highway 46. Everything outside this area shall be paid at full subsistence provide said job is of five (5) days duration or more and provide there is storage on the job for the Employee's tools. The Employer will be responsible for loss of tools under such circumstances. (Road: The most direct route on a surfaced road).

On all jobs or projects outside the free zone, as stated above, Employees may be required to report to the job site in their own transportation at the regular starting time and remain on the job site until the regular quitting time and these shall be paid at fifty dollars ($50.00) per day or fifty-one cents ($0.51) per mile for each road mile from shop to job and job to shop (round trip). (Day worked shall mean at least four (4) hours on the job unless sent home on account of weather, emergency, sickness, or injury).

The Employer shall pay for traveling time and furnish transportation from shop to job, job to job, and job to shop. Travel time shall be at the appropriate rate of pay for that day of the week. (Monday through Friday, straight time, Saturday and Sunday, double time.)

ELEC0639-003 12/26/2016

COMMUNICATIONS AND SYSTEMS WORK

SAN LUIS OBISPO COUNTY

	Rates	Fringes
Communications System		
Installer	$ 32.50	11.66
Technician	$ 30.89	11.66

SCOPE OF WORK: Installation, testing, service and maintenance of systems utilizing the transmission and/or transference of voice, sound, vision and digital for commercial,

educational, security and entertainment purposes for the following: TV monitoring and surveillance, background - foreground music, intercom and telephone interconnect, microwave transmission, multi-media, multiplex, nurse call systems, radio page, burglar alarms and fire alarm (see last paragraph below).

Communication Systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding all other data systems or multiple systems which include control function or power supply; excluding installation of raceway systems, conduit systems, line voltage work, and energy management systems.

Fire alarm work shall be performed at the current inside electrician total cost package.

ELEC1245-001 06/01/2015

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer	$ 52.85	15.53
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment)	$ 42.21	14.32
(3) Groundman	$ 32.28	14.03
(4) Powderman	$ 47.19	14.60

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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ELEV0008-003 01/01/2017

	Rates	Fringes
ELEVATOR MECHANIC	$ 63.44	31.585

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 07/01/2016

	Rates	Fringes
OPERATOR: Power Equipment (All Other Work)		
GROUP 1	$ 39.95	23.35
GROUP 2	$ 40.73	23.35
GROUP 3	$ 41.02	23.35
GROUP 4	$ 42.51	23.35
GROUP 5	$ 41.86	23.35
GROUP 6	$ 41.83	23.35
GROUP 8	$ 42.84	23.35
GROUP 9	$ 42.19	23.35
GROUP 10	$ 42.96	23.35
GROUP 11	$ 42.31	23.35
GROUP 12	$ 43.13	23.35
GROUP 13	$ 43.23	23.35
GROUP 14	$ 43.26	23.35
GROUP 15	$ 43.34	23.35
GROUP 16	$ 43.46	23.35
GROUP 17	$ 43.63	23.35
GROUP 18	$ 43.73	23.35
GROUP 19	$ 43.84	23.35

GROUP 20	$ 43.96	23.35
GROUP 21	$ 44.13	23.35
GROUP 22	$ 44.23	23.35
GROUP 23	$ 44.34	23.35
GROUP 24	$ 44.46	23.35
GROUP 25	$ 44.63	23.35

OPERATOR: Power Equipment (Cranes, Piledriving & Hoisting)

GROUP 1	$ 43.20	22.15
GROUP 2	$ 43.98	22.15
GROUP 3	$ 44.27	22.15
GROUP 4	$ 44.41	22.15
GROUP 5	$ 44.63	22.15
GROUP 6	$ 44.74	22.15
GROUP 7	$ 44.86	22.15
GROUP 8	$ 45.03	22.15
GROUP 9	$ 45.20	22.15
GROUP 10	$ 46.20	22.15
GROUP 11	$ 47.20	22.15
GROUP 12	$ 48.20	22.15
GROUP 13	$ 49.20	22.15

OPERATOR: Power Equipment (Tunnel Work)

GROUP 1	$ 41.80	23.35
GROUP 2	$ 42.58	23.35
GROUP 3	$ 42.87	23.35
GROUP 4	$ 43.01	23.35
GROUP 5	$ 43.23	23.35
GROUP 6	$ 43.34	23.35
GROUP 7	$ 43.46	23.35

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 08/01/2015

	Rates	Fringes
OPERATOR: Power Equipment (DREDGING)		
(1) Leverman	$ 49.50	23.60
(2) Dredge dozer	$ 43.53	23.60
(3) Deckmate	$ 43.42	23.60
(4) Winch operator (stern winch on dredge)	$ 42.87	23.60
(5) Fireman-Oiler, Deckhand, Bargeman, Leveehand	$ 42.33	23.60
(6) Barge Mate	$ 42.94	23.60

IRON0377-002 07/01/2016

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 28.33	20.64
Ornamental, Reinforcing and Structural	$ 34.75	29.20

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

LABO0220-001 07/04/2016

	Rates	Fringes
LABORER (TUNNEL)		
GROUP 1	$ 38.09	19.07
GROUP 2	$ 38.41	19.07
GROUP 3	$ 38.87	19.07
GROUP 4	$ 39.56	19.07
LABORER		
GROUP 1	$ 32.34	19.07
GROUP 2	$ 32.89	19.07
GROUP 3	$ 33.44	19.07
GROUP 4	$ 34.99	19.07
GROUP 5	$ 35.34	19.07

LABORER CLASSIFICATIONS

GROUP 1: Cleaning and handling of panel forms; Concrete screeding for rough strike-off; Concrete, water curing; Demolition laborer, the cleaning of brick if performed by a worker performing any other phase of demolition work, and the cleaning of lumber; Fire watcher, limber, brush loader, piler and debris handler; Flag person; Gas, oil and/or water pipeline laborer; Laborer, asphalt-rubber material loader; Laborer, general or construction; Laborer, general clean-up; Laborer, landscaping; Laborer, jetting; Laborer, temporary water and air lines; Material hose operator (walls, slabs, floors and decks); Plugging, filling of shee bolt holes; Dry packing of concrete; Railroad maintenance, repair track person and road beds; Streetcar and railroad construction track laborers; Rigging and signaling; Scaler; Slip form raiser; Tar and mortar; Tool crib or tool house laborer; Traffic control by any method; Window cleaner; Wire mesh pulling - all concrete pouring operations

GROUP 2: Asphalt shoveler; Cement dumper (on 1 yd. or larger mixer and handling bulk cement); Cesspool digger and installer; Chucktender; Chute handler, pouring concrete, the handling of the chute from readymix trucks, such as walls, slabs, decks, floors, foundation, footings, curbs, gutters and sidewalks; Concrete curer, impervious membrane and form oiler; Cutting torch operator (demolition); Fine grader, highways and street paving, airport, runways and similar type heavy construction; Gas, oil and/or water pipeline wrapper - pot tender and form person; Guinea chaser; Headerboard person - asphalt; Laborer, packing rod steel and pans; Membrane vapor barrier installer; Power broom sweeper (small); Riprap stonepaver, placing stone or wet sacked concrete; Roto scraper and tiller; Sandblaster (pot tender); Septic tank digger and installer(lead); Tank scaler and cleaner; Tree climber, faller, chain saw operator, Pittsburgh chipper and similar type brush shredder; Underground laborer, including caisson bellower

GROUP 3: Buggymobile person; Concrete cutting torch; Concrete pile cutter; Driller, jackhammer, 2-1/2 ft. drill steel or longer; Dri-pak-it machine; Gas, oil and/or water pipeline wrapper, 6-in. pipe and over, by any method, inside and out; High scaler (including drilling of same); Hydro seeder and similar type; Impact wrench multi-plate; Kettle person, pot person and workers applying asphalt, lay-kold, creosote, lime caustic and similar type materials ("applying" means applying, dipping, brushing or handling of such materials for pipe wrapping and waterproofing); Operator of pneumatic, gas, electric tools, vibrating machine, pavement breaker, air blasting, come-alongs, and similar mechanical tools not separately classified herein; Pipelayer's backup person, coating, grouting, making of joints, sealing, caulking, diapering and including rubber gasket joints, pointing and any and all other services; Rock slinger; Rotary scarifier or multiple head concrete chipping scarifier; Steel headerboard and guideline setter; Tamper, Barko, Wacker and similar type; Trenching machine, hand-propelled

GROUP 4: Asphalt raker, lute person, ironer, asphalt dump person, and asphalt spreader boxes (all types); Concrete core cutter (walls, floors or ceilings), grinder or sander; Concrete saw person, cutting walls or flat work, scoring old or new concrete; Cribber, shorer, lagging, sheeting and trench bracing, hand-guided lagging hammer; Head rock slinger; Laborer, asphalt- rubber distributor boot person; Laser beam in connection with laborers' work; Oversize concrete vibrator operator, 70 lbs. and over; Pipelayer performing all services in the laying and installation of pipe from the point of receiving pipe in the ditch until completion of operation, 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 (nozzle person), water blasting, Porta Shot-Blast

GROUP 5: Blaster powder, 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; 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; Toxic waste removal

TUNNEL LABORER CLASSIFICATIONS

GROUP 1: Batch plant laborer; Changehouse person; Dump person; Dump person (outside); Swamper (brake person and switch person on tunnel work); Tunnel materials handling person; Nipper; Pot tender, using mastic or other materials (for example, but not by way of limitation, shotcrete, etc.);

GROUP 2: Bull gang mucker, track person; Chucktender, Cabletender; Concrete crew, including rodder and spreader; Loading and unloading agitator cars; Vibrator person, jack hammer, pneumatic tools (except driller)

GROUP 3: Blaster, driller, powder person; Chemical grout jet person; Cherry picker person; Grout gun person; Grout mixer person; Grout pump person; Jackleg miner; Jumbo person; Kemper and other pneumatic concrete placer operator; Miner, tunnel (hand or machine); Nozzle person; Operating of troweling and/or grouting machines; Powder person (primer house); Primer person; Sandblaster; Shotcrete person; Steel form raiser and setter; Timber person, retimber person, wood or steel; Tunnel Concrete finisher

GROUP 4: Diamond driller; Sandblaster; Shaft and raise work

LABO0220-004 07/01/2016

	Rates	Fringes
Brick Tender	$ 30.52	18.56

LABO0300-005 01/01/2017

	Rates	Fringes
Asbestos Removal Laborer	$ 31.88	16.82

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.

LABO0345-001 07/03/2016

	Rates	Fringes
LABORER (GUNITE)		
GROUP 1	$ 37.89	20.50
GROUP 2	$ 36.94	20.50
GROUP 3	$ 33.40	20.50

FOOTNOTE: GUNITE PREMIUM PAY: Workers working from a Bosn'n's Chair or suspended from a rope or cable shall receive 40 cents per hour above the foregoing applicable classification rates. Workers doing gunite and/or shotcrete work in a tunnel shall receive 35 cents per hour above the foregoing applicable classification rates, paid on a portal-to-portal basis. Any work performed on, in or above any smoke stack, silo, storage elevator or similar type of structure, when such structure is in excess of 75'-0" above base level and which work must be performed in whole or in part more than 75'-0" above base level, that work performed above the 75'-0" level shall be compensated for at 35 cents per hour above the applicable classification wage rate.

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Rodmen, Nozzlemen

GROUP 2: Gunmen

GROUP 3: Reboundmen

LABO1184-001 07/04/2016

	Rates	Fringes
Laborers: (HORIZONTAL DIRECTIONAL DRILLING)		
(1) Drilling Crew Laborer	$ 33.65	13.95
(2) Vehicle Operator/Hauler	$ 33.82	13.95
(3) Horizontal Directional Drill Operator	$ 35.67	13.95
(4) Electronic Tracking Locator	$ 37.67	13.95
Laborers: (STRIPING/SLURRY SEAL)		
GROUP 1	$ 34.86	17.03
GROUP 2	$ 36.16	17.03
GROUP 3	$ 38.17	17.03
GROUP 4	$ 39.91	17.03

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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LABO1414-001 08/03/2016

	Rates	Fringes
LABORER		
PLASTER CLEAN-UP LABORER	$ 31.60	19.28
PLASTER TENDER	$ 34.15	19.28

Work on a swing stage scaffold: $1.00 per hour additional.

PAIN0036-007 08/01/2016

	Rates	Fringes
Painters:		
(1) Repaint Including Lead Abatement	$ 24.40	13.24
(2) High Iron & Steel	$ 30.70	12.83
(3) Journeyman Painter including Lead Abatement	$ 29.04	13.24

(4) Industrial.....$ 32.52 13.34
(5) All other work.....$ 29.04 13.24

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.

HIGH IRON & STEEL:
Aerial towers, towers, radio towers, smoke stacks, flag poles (any flag poles that can be finished from the ground with a ladder excluded), elevated water towers, steeples and domes in their entirety and any other extremely high and hazardous work, cooning steel, bos'n chair, or other similar devices, painting in other high hazardous work shall be classified as high iron & steel

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PAIN0036-008 10/01/2016

	Rates	Fringes
DRYWALL FINISHER/TAPER	$ 37.18	17.99

PAIN0169-002 01/01/2017

	Rates	Fringes
GLAZIER	$ 34.93	24.03

PAIN1247-002 05/01/2017

	Rates	Fringes
SOFT FLOOR LAYER	$ 32.35	14.56

PLAS0200-001 08/05/2015

	Rates	Fringes
PLASTERER	$ 38.44	13.77

PLAS0500-002 07/01/2016

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 33.30	23.33

PLUM0016-001 07/01/2016

	Rates	Fringes
PLUMBER/PIPEFITTER		
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	$ 47.19	21.41
Work ONLY on new additions and remodeling of bars, restaurant, stores and commercial buildings not to exceed 5,000 sq. ft. of floor space	$ 45.73	20.43
Work ONLY on strip malls, light commercial, tenant improvement and remodel work	$ 35.69	18.76

PLUM0345-001 07/01/2014

	Rates	Fringes

PLUMBER
Landscape/Irrigation Fitter.$ 29.27 19.75
Sewer & Storm Drain Work....$ 33.24 17.13

ROOF0036-002 08/01/2015

	Rates	Fringes
ROOFER	$ 35.07	14.40

FOOTNOTE: Pitch premium: Work on which employees are exposed to pitch fumes or required to handle pitch, pitch base or pitch impregnated products, or any material containing coal tar pitch, the entire roofing crew shall receive $1.75 per hour "pitch premium" pay.

SFCA0669-014 04/01/2017

	Rates	Fringes
SPRINKLER FITTER	$ 37.20	15.84

SHEE0273-002 08/01/2016

	Rates	Fringes
SHEET METAL WORKER	$ 40.46	27.90

HOLIDAYS: New Year's Day, Martin Luther King Day, President's Day, Good Friday, Memorial Day, Indepdendence Day, Labor Day, Veterans Day,Thankisgiving Day & Friday after, Christmas Day

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TEAM0011-002 08/01/2016

	Rates	Fringes
TRUCK DRIVER		
GROUP 1	$ 29.09	26.39
GROUP 2	$ 29.24	26.39
GROUP 3	$ 29.37	26.39
GROUP 4	$ 29.56	26.39
GROUP 5	$ 29.59	26.39
GROUP 6	$ 29.62	26.39
GROUP 7	$ 29.87	26.39
GROUP 8	$ 30.12	26.39
GROUP 9	$ 30.32	26.39
GROUP 10	$ 30.62	26.39
GROUP 11	$ 31.12	26.39
GROUP 12	$ 31.55	26.39

WORK ON ALL MILITARY BASES:
PREMIUM PAY: $3.00 per hour additional.
[29 palms Marine Base, Camp Roberts, China Lake, Edwards AFB, El Centro Naval Facility, Fort Irwin, Marine Corps Logistics Base at Nebo & Yermo, Mountain Warfare Training Center, Bridgeport, Point Arguello, Point Conception, Vandenberg AFB]

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Truck driver

GROUP 2: Driver of vehicle or combination of vehicles - 2 axles; Traffic control pilot car excluding moving heavy equipment permit load; Truck mounted broom

GROUP 3: Driver of vehicle or combination of vehicles - 3 axles; Boot person; Cement mason distribution truck; Fuel truck driver; Water truck - 2 axle; Dump truck, less than 16 yds. water level; Erosion control driver

GROUP 4: Driver of transit mix truck, under 3 yds.; Dumpcrete truck, less than 6-1/2 yds. water level

GROUP 5: Water truck, 3 or more axles; Truck greaser and tire person ($0.50 additional for tire person); Pipeline and

utility working truck driver, including winch truck and plastic fusion, limited to pipeline and utility work; Slurry truck driver

GROUP 6: Transit mix truck, 3 yds. or more; Dumpcrete truck, 6-1/2 yds. water level and over; Vehicle or combination of vehicles - 4 or more axles; Oil spreader truck; Dump truck, 16 yds. to 25 yds. water level

GROUP 7: A Frame, Swedish crane or similar; Forklift driver; Ross carrier driver

GROUP 8: Dump truck, 25 yds. to 49 yds. water level; Truck repair person; Water pull - single engine; Welder

GROUP 9: Truck repair person/welder; Low bed driver, 9 axles or over

GROUP 10: Dump truck - 50 yds. or more water level; Water pull - single engine with attachment

GROUP 11: Water pull - twin engine; Water pull - twin engine with attachments; Winch truck driver - $1.25 additional when operating winch or similar special attachments

GROUP 12: Boom Truck 17K and above

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

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 a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 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. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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

PART 2

CONTRACT FORMS

AGREEMENT FORM

THIS AGREEMENT, dated_____, is by and between _____ ("Buyer")

and _____ ("Seller")
for Goods and Special Services in connection with the San Luis Obispo Water Resource Recovery Facility (the Project).

Buyer and Seller, hereby agree as follows:

1. GOODS AND SPECIAL SERVICES.

   1.1. Seller shall furnish Goods and Special Services as specified or indicated in the Contract Documents. Goods and Special Services to be furnished are described in Contract Documents.

2. ENGINEER.

   2.1. The Contract Documents for the Goods and Special Services have been prepared by CH2M HILL, Inc., which is to act as Buyer's representative, assume all duties and responsibilities, and have rights and authority assigned to Engineer in the Contract Documents in connection with Seller's furnishing of Goods and Special Services.

3. POINT OF DESTINATION.

   3.1. The Point of Destination is designated as The San Luis Obispo Water Resource Recovery Facility, 35 Prado Road, San Luis Obispo, CA 93401.

4. CONTRACT TIMES.

   4.1. Time is of the Essence:

      4.1.1. All time limits for Milestones, if any, including submittal of Shop Drawings and Samples, delivery of Goods, and furnishing of Special Services as stated in the Contract Documents are of the essence of the Contract.

   4.2. Milestones:

      4.2.1. Date for Submittal No. 1 of Shop Drawings, Equipment System Information and Samples: Seller shall submit Shop Drawings, Equipment System Information and Samples required by the Contract Documents to Buyer for Engineer's review and approval as described in Section 01 30 00, Administrative Requirements, and within the timeframe listed in Section 01 29 00, Measurement and Payment. Subsequent submittals shall be provided as described in Section 01 29 00, Measurement and Payment, and

Section 01 30 00, Administrative Requirements. It is the intent of the parties that:

4.2.1.1. Engineer conduct such review and issue its approval, or a denial accompanied by substantive comments regarding information needed to gain approval, within 10 days of Seller's submittal of such Shop Drawings, Equipment System Information and Samples; and

4.2.1.2. Resubmittals be limited whenever possible. If more than one resubmittal is needed for reasons other than the fault of the Engineer or Buyer, Seller shall pay Buyer the engineering fees incurred to review the additional resubmittals. If more than one resubmittal is necessary for reasons not the fault and beyond the control of Seller, Seller may pursue additional compensation under Paragraph 7.02B of the General Conditions.

4.2.2. Date for Delivery of Goods: Seller shall deliver all Goods to the Point of Destination and ready for Buyer's receipt of delivery as determined by the San Luis Obispo Water Resource Recovery Construction Contractor. The delivery date estimated to be approximately July 2019.

4.2.3. Days for Furnishing Special Services: Seller shall furnish Special Services in accordance with the Milestones set forth above and during the Project design phase as indicated in Section 01 29 00, Measurement and Payment.

4.3. Buyer's Final Inspection:

4.3.1. Buyer shall make its final inspection of the Goods pursuant to Paragraph 8.01.C of the General Conditions within 20 days after Buyer's acknowledgement of receipt of delivery of the Goods and Seller's completion of furnishing Special Services, if any. Date shall be adjusted equitably if Seller fails to deliver the Goods or furnish Special Services in compliance with the Milestones established in above paragraphs of this Agreement.

4.4. Liquidated Damages for Delay: Buyer and Seller recognize that Buyer will suffer financial loss if Seller does not perform the Special Services in accordance with the Goods are not delivered at the Point of Destination and ready for receipt of delivery by Buyer within times specified in Section 01 29 00, Measurement and Payment, plus any extensions thereof allowed in accordance with Article 7 of the General Conditions. The parties also recognize timely performance of services by others involved in the Project are dependent upon Seller's specific compliance with requirements specified in Date for Delivery of Goods. Further, they recognize the delays, expense, and difficulties involved in proving actual loss suffered by Buyer if complete acceptable Goods are not delivered on time. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for delay (but

not as a penalty) Seller shall pay Buyer the amount set forth in Section 01 29 00, Measurement and Payment, for each day that expires after the times specified in Section 01 29 00, Measurement and Payment. Liquidated damages will be assessed each day each milestone activity is delayed. Supplier agrees to pay such liquidated damages as herein provided, and in case the same are not paid, agrees that Buyer may deduct the amount thereof from any monies due or that may become due the Supplier under the Agreement. Supplier's Surety shall be liable for all liquidated damages not paid by Supplier. This liquidated damages provision does not affect Buyer's right to terminate this Agreement.

5. CONTRACT PRICE.

5.1. Buyer shall pay Seller for furnishing Goods and Special Services in accordance with the Contract Documents in current funds as follows. This amount includes $200,000 as an "Allowance," which shall be paid only as provided in Section 01 29 00, Measurement and Payment, Article Allowance for Spare Parts and Unforeseen Design Changes and Scope Modifications ("Allowance").

TOTAL SUM OF _____ Dollars
(use words)

and _____ Cents $_____
(use words) (figures)

5.2. Discrepancies between words and figures will be resolved in favor of words.

5.3. Buyer will make payment in accordance with the Contract Documents.

6. SYSTEM PERFORMANCE: PENALTIES AND LIQUIDATED DAMAGES FOR EXCESS POWER COSTS.

6.1. The Seller guarantees that the Membrane Equipment System shall meet all performance requirements and, specifically, Seller guarantees the annual power costs as entered on Schedule "A" for the following cost factors:

- Item D.1 – Air Scour.
- Item D.2 – Process Air Credit.
- Item D.3 – Permeate Pumping.
- Item D.4 – Backpulse Pumping.

6.2. Actual power consumption at each of the flowrates listed on the Schedule "A" Worksheets shall be confirmed by the Engineer during Performance Testing as specified in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor). Performance Testing shall be conducted to confirm that the Membrane Equipment System will meet all requirements and that the guaranteed annual costs for the items listed hereinbefore are not exceeded.

6.3. Buyer and Seller recognize that if the sum of the actual power consumption costs exceeds the guaranteed values entered by the Seller in Schedule "A," Lifecycle Cost Evaluation Form, for Items D.1 through D.5, the Buyer will suffer financial loss over the life of the Membrane Equipment System. Further, they recognize the delays, expense, and difficulties involved in proving actual loss suffered by Buyer. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for excess power costs, Seller shall pay the Owner, as liquidated damages and not as a penalty, an amount equal to two times the present worth value of the calculated difference in the actual and guaranteed power consumption costs for the 10-year period at a 5 percent discount rate. The present worth factor for this calculation is 7.772 times the annual difference in actual versus guaranteed power costs. Supplier agrees to pay such liquidated damages as herein provided within thirty (30) days of Buyer's written demand and in case the same are not paid, agrees that Buyer may deduct the amount thereof from any monies due or that may become due the Supplier under the Agreement. Supplier's Surety shall be liable for all liquidated damages not paid by Supplier.

6.4. An example calculation is provided in the table below for clarity. In this example, the Seller would pay the Owner $42,901 as compensation for the additional increased power consumption for the Membrane Equipment System. The Owner will not pay the Seller if the actual costs are less than the guaranteed costs.

Description of Item from Schedule "A" – Lifecycle Cost Evaluation Form	**Annual Cost Guaranteed by Seller in Schedule "A" Lifecycle Cost Evaluation Form**	**Actual Annual Power Costs as Determined by Engineer During Performance Testing**	**Net Increase (Decrease) in Actual Annual Power Costs Compared to Guaranteed Power Costs**	**Liquidated Damages (2 times 7.772 times Annual Power Costs Increase/ Decrease)**
D.1 Air Scour	$20,000	$22,000	$2,000`	$31,088.00
D.2 Process Air Credit	($4,800)	($7,040)	($2,240)	($34,818.56)
D.3 Permeate Pumping	$45,000	$43,000	($2,000)	($31,088.00)
D.5 Backpulse Pumping	$7,500	$12,500	$5,000	$77,720.00
Totals	$67,700	$70,460	$2,760	**$42,901**

7. SYSTEM PERFORMANCE: COST OF ADDITIONAL MEMBRANE BASIN VOLUME.

7.1. If the Membrane Equipment System is not meeting the performance requirement, and Buyer or Seller determines that additional membrane basin volume is required, over and above the volume proposed by the Seller in Schedule "A", the Seller will pay the actual cost to design, furnish and install the additional tank liquid volume required including liquid volume above and below the cassettes and between the cassettes and adjacent walls. The "actual cost" will include professional services, labor, material, equipment and all other costs Buyer incurs in constructing additional membrane basin volume.

8. PAYMENT PROCEDURES.

8.1. Submission and Processing of Payments: Seller shall submit Applications for Payment in accordance with Article 10 of the General Conditions. Applications for Payment will be processed by Engineer in accordance with the General Conditions and Section 01 29 00, Measurement and Payment. Following assignment of this Agreement to the construction contractor, applications for payment will be processed by construction contractor as provided in the general conditions of the contract for construction.

9. SELLER'S REPRESENTATIONS.

9.1. In order to induce Buyer to enter into this Agreement, Seller makes the following representations:

9.1.1. Seller has examined and carefully studied the Contract Documents and other related data identified in Proposal Documents.

9.1.2. If required by Proposal Documents to visit Point of Destination and site where the Goods are to be installed or Special Services will be provided, or if in Seller's judgment, any local condition may affect cost, progress or furnishing of Goods and Special Services, Seller has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided and become familiar with and is satisfied as to local conditions that may affect cost, progress, or furnishing of Goods and Special Services.

9.1.3. Seller is familiar with and is satisfied as to Laws and Regulations that may affect cost, progress, and furnishing of Goods and Special Services.

9.1.4. Seller has carefully studied, considered, and correlated information known to Seller; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided;

information and observations obtained from Seller's visits, if any, to the Point of Destination and site where the Goods are to be installed or Services will be provided; and any reports and drawings identified in the Proposal Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Contract Documents.

9.1.5. Seller has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Seller has discovered in the Contract Documents, and written resolution thereof by Engineer is acceptable to Seller.

9.1.6. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services.

10. CONTRACT DOCUMENTS.

10.1. Contents: The Contract Documents consist of the following:

10.1.1. This Agreement (pages 1 to ____, inclusive);

10.1.2. SRF Requirements as identified in the Contract Documents.

10.1.3. Exhibit A-1 to Agreement between Buyer and Seller dated, Assignment of Contract; Consent to Agreement; and Acceptance of Assignment;

10.1.4. Exhibit A-2 to Agreement between Buyer and Seller dated, Agreement to Assignment by Seller's Surety;

10.1.5. Performance Bond (pages 1 to ____, inclusive);

10.1.6. Payment Bond (pages 1 to _____, inclusive);

Other Bonds: _____ (pages ____ to ____, inclusive);

10.1.7. Instructions to Proposers;

10.1.8. Request for Proposals;

10.1.9. EJCDC P-700 Standard General Conditions for Procurement Contracts, pages 1-22 ("General Conditions");

10.1.10. Supplementary Conditions (pages ____ to ____, inclusive);

10.1.11. Drawings prepared by CH2M HILL, ("Drawings");

10.1.12. Specifications as listed in Table of Contents of the Project Manual dated July 2017;

10.1.13. Drawings, consisting of a cover sheet and sheets numbered ____ through ____, inclusive, with each sheet bearing the following general title: San Luis Obispo Membrane Equipment System.

10.1.14. Addenda (Numbers ____ to____, inclusive);

10.1.15. Seller's Proposal (pages ____ to ____, inclusive);

10.1.16. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

10.1.16.1. Notice to Proceed (pages ____ to ____, inclusive);

10.1.16.2. Written Amendment(s);

10.1.16.3. Field Order(s);

10.1.16.4. Change Order(s);

10.1.16.5. Work Change Directive(s).

10.2. All of the documents listed in this Paragraph 10 are incorporated into and made part of this Agreement as if fully set forth herein.

10.3. There are no Contract Documents other than those listed above in this Article.

10.4. The Contract Documents may only be amended, or supplemented as provided in Paragraph 3.04 of the General Conditions.

10.5. The Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all.

10.6. The Contract Documents are intended to be fully cooperative and to be complementary. If Contractor observes that any documents are in conflict, the Contractor shall promptly notify the Engineer in writing. In case of conflicts between the Contract Documents, the order of precedence shall be as follows:

10.6.1. Change Orders or Work Change Directives, the most recent first;

10.6.2. Addenda, the most recent first;

10.6.3. State Revolving Fund Requirements;

10.6.4. Supplementary Conditions;

10.6.5. Specifications prepared by CH2M HILL and dated July 2017;

10.6.6. Drawings prepared by CH2M HILL included in the Request for Proposals;

10.6.7. Agreement, including Exhibits A-1 and A-2;

10.6.8. General Conditions;

10.6.9. Instructions to Proposers;

10.6.10. Request for Proposals;

10.6.11. Reference Documents;

10.6.12. Seller's Proposal.

10.7. With reference to Drawings, the order of precedence shall be as follows:

10.7.1. Figures govern over scaled dimensions.

10.7.2. Detail drawings govern over general drawings.

10.7.3. Addenda or Change Order drawings govern over Contract Drawings.

10.7.4. Contract Drawings govern over Standard Drawings.

Notwithstanding the orders of precedence established above, in the event of conflicts, the higher standard shall always apply.

Organization of Contract Documents. Organization of the Contract Documents into divisions, sections, and articles, and arrangement of drawings shall not control the Contractor in dividing The Work among subcontractors or in establishing the extent of Work to be performed by any trade.

11. MISCELLANEOUS.

11.1. Defined Terms: Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

11.2. Assignment of Contract:

11.2.1.1. Owner has the right to assign this Agreement and Seller shall accept such assignment. Forms documenting the assignment of the Agreement, and consent of Seller's surety to the assignment are attached as exhibits to this Agreement. The Agreement will be executed in the name of Buyer initially, and will be assigned to a construction contractor (assignee) designated by Buyer. Assignment

will occur on effective date of the Agreement between Buyer and construction contractor, which is expected to occur on or about September 3, 2018. As of the date of acceptance of assignment by assignee, all references in the Contract Documents to Buyer shall mean designated assignee whose responsibilities will include installation or erection or incorporation the Goods.

11.2.1.2. Assignment of the Contract shall relieve Buyer from all further obligations and liabilities under this Contract. After assignment, Seller shall become a subcontractor or supplier to assignee and, except as noted herein, all rights, duties, and obligations of Buyer under the Contract shall become the rights, duties, and obligations of assignee.

11.2.1.3. After Assignment:

11.2.1.3.1. All performance warranties, guarantees, and indemnification required by the Contract Documents will continue to run for the benefit of Buyer and, in addition, for the benefit of assignee. However, if Buyer and assignee make the same warranty or guarantee claim, then Seller shall only be liable once for such claim.

11.2.1.3.2. Except as provided in this Paragraph, all rights, duties, and obligations of Engineer to assignee and Seller under this Contract will cease.

11.2.1.3.2.1. Engineer will review Seller's Applications for Payment and make recommendations to assignee for payments as provided in Paragraph 10.02 and Paragraph 10.06 of the General Conditions.

11.2.1.3.2.2. Upon written request of either assignee or Seller, Engineer will issue with reasonable promptness such clarifications or interpretations of the Contract Documents pursuant to terms of Paragraph 9.02.A of the General Conditions.

11.2.2. No other assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound. Specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by Laws and Regulations). Unless specifically

stated to the contrary in any written consent to an assignment, no assignment will release or discharge assignor from any duty or responsibility under the Contract Documents.

11.3. Successors and Assigns: Buyer and Seller each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

11.4. Severability: Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Buyer and Seller. The Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

11.5. Seller's Certifications: Seller certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Agreement. For the purposes of this paragraph:

11.5.1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the proposal process or in the Agreement execution;

11.5.2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the proposal process or the execution of the Agreement to the detriment of Buyer, (b) to establish Proposal or Contract prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;

11.5.3. "collusive practice" means a scheme or arrangement between two or more Proposers, with or without the knowledge of Buyer, a purpose of which is to establish Proposal prices at artificial, non-competitive levels; and

11.5.4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the Proposal process or affect the execution of the Agreement.

IN WITNESS WHEREOF, Buyer and Seller have signed this Agreement. Counterparts have been delivered to Buyer and Seller. All portions of the Contract Documents have been signed or identified by Buyer and Seller or on their behalf.

This Agreement will be effective on _____ (which is the Effective Date of the Agreement). *(date)*

Buyer: _____

By: _____
(Corporate Seal)

Attest: _____

Address for giving notice:

_____

_____

_____

(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.)

Designated Representative:

Name: _____

Title: _____

Address: _____

Phone: _____

Facsimile: _____

Seller: _____

By: _____
(Corporate Seal)

Attest: _____

Address for giving notice:

_____

_____

_____

Agent for service of process:

_____

_____

(If Seller is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:

Name: _____

Title: _____

Address: _____

Phone: _____

Facsimile: _____

END OF SECTION

EXHIBIT A-1 to Agreement between Buyer and Seller Dated: _____

ASSIGNMENT OF CONTRACT; CONSENT TO ASSIGNMENT; AND ACCEPTANCE OF ASSIGNMENT

This assignment will be effective on the Effective Date of the Agreement between Buyer and Construction Contractor.

The Contract between _____ ("Buyer")

and _____ ("Seller")

for furnishing Goods and Special Services under the Contract Documents entitled _____

_____ is hereby assigned, transferred, and set over to

_____ ("Construction Contractor"). Construction Contractor shall be totally responsible for the performance of Seller and for the duties, rights, and obligations of Buyer, not otherwise retained by Buyer, under the terms of the Agreement between Buyer and Seller.

ASSIGNMENT DIRECTED BY:

_____
Buyer

(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.)

By: _____
(Signature) (Title)

ASSIGNMENT ACKNOWLEDGED AND ACCEPTED BY:

_____
Seller

(If Seller is a corporation, attach evidence of authority to sign.)

By:_____
(Signature) (Title)

ASSIGNMENT ACCEPTED BY:

_____
Construction Contractor

(If Construction Contractor is a corporation, attach evidence of authority to sign.)

By:_____
(Signature) (Title)

EXHIBIT A-2 to Agreement between Buyer and Seller Dated: _____

AGREEMENT TO ASSIGNMENT BY SELLER'S SURETY

Surety has issued Payment Bond and a Performance Bond naming Seller as principal, Bond Nos._____, for the benefit of Buyer in connection with the Agreement Membrane Equipment System. Surety hereby acknowledges and agrees that the Contract for furnishing Goods and Special.

Services under the Contract Documents entitled _____

by and between _____ ("Buyer") and

_____
("Seller")

may be assigned, transferred, and set over to_____
("Construction Contractor"), in accordance with Article Miscellaneous, subparagraph, Assignment of Contract.

Surety further agrees that, upon assignment of the Contract, Construction Contractor shall have all the rights of Buyer under the Performance and Payment Bonds.

(Corporate Seal)

Surety

Company: _____

By: _____
Signature and Title
(Attach Power of Attorney)

PERFORMANCE BOND

Any singular reference to Seller, surety, Buyer or other party shall be considered plural where applicable.

SELLER
(Name and Address):

_____

_____

_____

SURETY
(Name and Address of Principal Place of Business):

_____

_____

_____

BUYER (Name and Address):

_____

_____

_____

BOND

Amount: _____

Date: _____
(Not later than Proposal due date)

CONTRACT

Date: _____

Amount: _____

Description (Name and Location): _____

Modifications to this Bond Form:

Surety and Seller, intending to be legally bound hereby, subject to the terms printed on the last page hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

SELLER AS PRINCIPAL

_____
Company Name and Corporate Seal

_____
Signature

_____
Name and Title

SURETY

_____
Company Name and Corporate Seal

_____
Signature

_____
Name and Title (Attach Power of Attorney)

_____
Address

_____

_____
Telephone

(Space is provided below for signatures of additional parties, if required.)

SELLER AS PRINCIPAL

Company Name and Corporate Seal

Signature

Name and Title

SURETY

Company Name and Corporate Seal

Signature

Name and Title (Attach Power of Attorney)

Address

Telephone

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer for the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns if, and when Buyer has assigned the Contract.

2. If Seller performs the Contract, Surety and Seller have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

3. If there is no Buyer Default, Surety's obligation under this Bond shall arise after:

3.1. Buyer has notified Seller and Surety pursuant to paragraph 10 that Buyer is considering declaring a Seller Default and has requested and attempted to arrange a conference with Seller and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. (If Buyer, Seller and Surety agree, Seller shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Buyer's right, if any, to subsequently declare a Seller Default); and

3.2. Buyer has declared a Seller Default and formally terminated Seller's right to complete the Contract. Such Seller Default shall not be declared earlier than 20 days after Seller and Surety have received notice as provided in paragraph 3.1; and

3.3. Buyer has agreed to pay the Balance of the Contract Price to:

1. Surety in accordance with the terms of the Contract;

2. Another seller selected pursuant to paragraph 4.3 to perform the Contract.

4. When Buyer has satisfied the conditions of paragraph 3, Surety shall promptly, and at Surety's expense, take one of the following actions:

4.1. Arrange for Seller, with consent of Buyer, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified sellers acceptable to Buyer for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Buyer and Seller selected with Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to Buyer the amount of damages as described in paragraph 6 in excess of the Balance of the Contract Price incurred by Buyer resulting from Seller Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances, either:

1. determine the amount for which it may be liable to Buyer and, as soon as practicable after the amount is determined, tender payment therefor to Buyer; or

2. deny liability in whole or in part and notify Buyer citing reasons therefor.

5. If Surety does not proceed as provided in paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.

6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1. The responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;

6.2. Additional legal, design professional and delay costs resulting from Seller's Default, and resulting from the actions or failure to act of Surety under paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.

7. Surety shall not be liable to Buyer or others for obligations of Seller that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Buyer or its heirs, executors, administrators, successors, or assigns.

8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Goods and Services are located and shall be instituted within two years after Seller Default or within two years after Seller ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Goods were to be delivered and the Special Services were to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1. Balance of the Contract Price: The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts received or to be received by Buyer in settlement of insurance or other Claims for damages to which Seller is entitled, reduced by all valid and proper payments made to or on behalf of Seller under the Contract.

12.2. Contract: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.

12.3. Seller Default: Failure of Seller, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. Buyer Default: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

END OF SECTION

PAYMENT BOND

Any singular reference to Seller, surety, Buyer or other party shall be considered plural where applicable.

SELLER
(Name and Address):

_____

_____

_____

SURETY
(Name and Address of Principal Place of Business):

_____

_____

_____

BUYER (Name and Address):

_____

_____

_____

BOND

Amount: _____

Date: _____
(Not later than Proposal due date)

Modifications to this Bond Form:

Surety and Seller, intending to be legally bound hereby, subject to the terms printed on the last page hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

SELLER AS PRINCIPAL

_____
Company Name and Corporate Seal

_____
Signature

_____
Name and Title

SURETY

_____
Company Name and Corporate Seal

_____
Signature

_____
Name and Title (Attach Power of Attorney)

_____
Address

_____

_____
Telephone

(Space is provided below for signatures of additional parties, if required.)

SELLER AS PRINCIPAL

Company Name and Corporate Seal

Signature

Name and Title

SURETY

Company Name and Corporate Seal

Signature

Name and Title (Attach Power of Attorney)

Address

Telephone

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.

2. With respect to Buyer, this obligation shall be null and void if Seller:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies and holds harmless Buyer from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Buyer has promptly notified Seller and Surety (at the addresses described in paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Seller and Surety, and provided there is no Buyer Default.

3. With respect to Claimants, this obligation shall be null and void if Seller promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with Seller have given notice to Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with Seller:

1. Have furnished written notice to Seller and sent a copy, or notice thereof, to Buyer, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from Seller or not received within 30 days of furnishing the above notice any communication from Seller by which Seller had indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Seller.

5. If a notice required by paragraph 4 is given by Buyer to Seller or to Surety, that is sufficient compliance.

6. When a Claimant has satisfied the conditions of paragraph 4, Surety shall promptly and at Surety's expense take the following actions:

6.1. Send an answer to the Claimant, with a copy to Buyer, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2. Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Buyer to Seller under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By Seller furnishing and Buyer accepting this Bond, they agree that all funds earned by Seller in the performance of the Contract are dedicated to satisfy obligations of Seller and Surety under this Bond, subject to Buyer's priority to use the funds for the completion of the furnishing the Goods and Special Services.

9. Surety shall not be liable to Buyer, Claimants or others for obligations of Seller that are unrelated to the Contract. Buyer shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Goods relevant to the claim are located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Buyer or Seller shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Buyer or Seller, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Seller shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions

15.1. Claimant: An individual or entity having a direct contract with Seller or with a Subcontractor of Seller to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for furnishing the Goods and Special Services by Seller and Seller's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2. Contract: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.

15.3. Buyer Default: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

END OF SECTION

PART 3

CONDITIONS OF THE CONTRACT

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS FOR PROCUREMENT CONTRACTS

Prepared by

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STANDARD GENERAL CONDITIONS
FOR PROCUREMENT CONTRACTS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Whenever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to the singular or plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument signed by both Buyer and Seller covering the Goods and Special Services and which lists the Contract Documents in existence on the Effective Date of the Agreement.

3. *Application for Payment*—The form acceptable to Buyer which is used by Seller in requesting progress and final payments and which is accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*— The offer or proposal of a Seller submitted on the prescribed form setting forth the prices for the Goods and Special Services to be provided.

5. *Bidder*—The individual or entity that submits a Bid directly to Buyer.

6. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and Bid Form with any supplements.

8. *Buyer*—The individual or entity purchasing the Goods and Special Services.

9. *Change Order*—A document which is signed by Seller and Buyer and authorizes an addition, deletion, or revision to the Contract Documents or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement. Change Orders may be the result of mutual agreement by Buyer and Seller, or of resolution of a Claim.

10. *Claim*—A demand or assertion by Buyer or Seller seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between Buyer and Seller concerning the Goods and Special Services. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Shop Drawings and other Seller submittals are not Contract Documents, even if accepted, reviewed, or approved by Engineer or Buyer.

13. *Contract Price*—The moneys payable by Buyer to Seller for furnishing the Goods and Special Services in accordance with the Contract Documents as stated in the Agreement.

14. *Contract Times*—The times stated in the Agreement by which the Goods must be delivered and Special Services must be furnished.

15. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Goods and Special Services to be furnished by Seller. Shop Drawings and other Seller submittals are not Drawings as so defined.

16. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

17. *Engineer*—The individual or entity designated as such in the Agreement.

18. *Field Order*—A written order issued by Engineer which requires minor changes in the Goods or Special Services but which does not involve a change in the Contract Price or Contract Times.

19. *General Requirements*—Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

20. *Goods*—The tangible and movable personal property that is described in the Contract Documents, regardless of whether the property is to be later attached to realty.

21. *Goods and Special Services*—The full scope of materials, equipment, other items, and services to be furnished by Seller, including Goods, as defined herein, and Special Services, if any, as defined herein. This term refers to both the Goods and the Special Services, or to either the Goods or the Special Services, and to any portion of the Goods or the Special Services, as the context requires.

22. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

23. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to the Contract Times.

24. *Notice of Award*—The written notice by Buyer to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Buyer will sign and deliver the Agreement.

25. *Notice to Proceed*—A written notice given by Buyer to Seller fixing the date on which the Contract Times commence to run and on which Seller shall start to perform under the Contract.

26. *Point of Destination*—The specific address of the location where delivery of the Goods shall be made, as stated in the Agreement.

27. *Project*—The total undertaking of which the Goods and Special Services may be the whole, or only a part.

28. *Project Manual*—The documentary information prepared for bidding and furnishing the Goods and Special Services. A listing of the contents of the Project Manual is contained in its table of contents.

29. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Goods and Special Services and which establish the standards by which such portion of the Goods and Special Services will be judged.

30. *Seller*—The individual or entity furnishing the Goods and Special Services.

31. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Seller and submitted by Seller to illustrate some portion of the Goods and Special Services.

32. *Special Services*—Services associated with the Goods to be furnished by Seller as required by the Contract Documents.

33. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the furnishing of the Goods and Special Services, and certain administrative requirements and procedural matters applicable thereto.

34. *Successful Bidder*—The Bidder submitting a responsive Bid, to whom Buyer makes an award.

35. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

36. *Work Change Directive*—A written statement to Seller issued on or after the Effective Date of the Agreement and signed by Buyer ordering an addition, deletion, or other revision in the Contract Documents with respect to the Goods and Special Services. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B and 1.02.C are not defined, but have the indicated meanings when used in the Bidding Requirements or Contract Documents.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Goods and Special Services. It is intended that such exercise of professional judgment, action, or determination will be commercially reasonable and will be solely to evaluate, in general, the Goods and Special Services for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing of Goods or Special Services or any duty or authority to undertake responsibility contrary to any other provision of the Contract Documents.

2. The word "non-conforming" when modifying the words "Goods and Special Services," "Goods," or "Special Services," refers to Goods and Special Services that fail to conform to the Contract Documents.

3. The word "receipt" when referring to the Goods, shall mean the physical taking and possession by the Buyer under the conditions specified in Paragraph 8.01.B.3.

4. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

5. The word "furnish," when used in connection with the Goods and Special Services shall mean to supply and deliver said Goods to the Point of Destination (or some other specified location) and to perform said Special Services fully, all in accordance with the Contract Documents.

C. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 *Delivery of Bonds*

A. When Seller delivers the executed counterparts of the Agreement to Buyer, Seller also shall deliver such bonds as Seller may be required to furnish.

2.02 *Evidence of Insurance*

A. When Seller delivers the executed counterparts of the Agreement to Buyer, Seller shall deliver to Buyer, with copies to each additional insured identified by name in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Seller is required to purchase and maintain in accordance with Article 4.

2.03 *Copies of Documents*

A. Buyer shall furnish Seller up to five printed or hard copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.04 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.05 *Designated Representatives*

A. Buyer and Seller shall each designate its representative at the time the Agreement is signed. Each representative shall have full authority to act on behalf of and make binding decisions in any matter arising out of or relating to the Contract.

2.06 *Progress Schedule*

A. Within 15 days after the Contract Times start to run, Seller shall submit to Buyer and Engineer an acceptable progress schedule of activities, including at a minimum, Shop Drawing and Sample submittals, tests, and deliveries as required by the Contract Documents. No progress payment will be made to Seller until an acceptable schedule is submitted to Buyer and Engineer.

B. The progress schedule will be acceptable to Buyer and Engineer if it provides an orderly progression of the submittals, tests, and deliveries to completion within the specified Milestones and the Contract Times. Such acceptance will not impose on Buyer or Engineer responsibility for the progress schedule, for sequencing, scheduling, or progress of the work nor interfere with or relieve Seller from Seller's full responsibility therefor. Such acceptance shall not be deemed to acknowledge the reasonableness and attainability of the schedule.

2.07 *Preliminary Conference*

A. Within 20 days after the Contract Times start to run, a conference attended by Seller, Buyer, Engineer and others as appropriate will be held to establish a working understanding among the parties as to the Goods and Special Services and to discuss the schedule referred to in Paragraph 2.06.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.08 *Safety*

A. Buyer and Seller shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss. When Seller's personnel, or the personnel of any subcontractor to Seller, are present at the Point of Destination or any work area or site controlled by Buyer, the Seller shall be responsible for the compliance by such personnel with any applicable requirements of Buyer's safety programs that are made known to Seller.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT AND AMENDING

3.01 *Intent*

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce or furnish the indicated Goods and Special Services will be provided, whether or not specifically called for, at no additional cost to Buyer.

C. Clarifications and interpretations of, or notifications of minor variations and deviations in, the Contract Documents, will be issued by Engineer as provided in Article 9.

3.02 *Standards, Specifications, Codes, Laws and Regulations*

A. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws and Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws and Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

B. No provision of any such standard, specification, manual or code, or any instruction of a supplier shall be effective to change the duties or responsibilities of Buyer or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Buyer or Engineer, or any of their consultants, agents, or employees any duty or authority to supervise or direct the performance of Seller's obligations or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Seller's Review of Contract Documents Before the Performance of the Contract*: Before performance of the Contract, Seller shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Seller shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Seller discovers or has actual knowledge of and shall obtain a written interpretation or clarification from Engineer before proceeding with the furnishing of any Goods and Special Services affected thereby.

2. *Seller's Review of Contract Documents During the Performance of the Contract:* If, during the performance of the Contract, Seller discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Contract, any standard, specification, manual or code, or of any instruction of any Supplier, Seller shall promptly report it to Engineer in writing. Seller shall not proceed with the furnishing of the Goods and Special Services affected thereby until an amendment to or clarification of the Contract Documents has been issued.

3. Seller shall not be liable to Buyer or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Seller had actual knowledge thereof.

B. *Resolving Discrepancies:* Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

1. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

2. the provisions of any Laws or Regulations applicable to the furnishing of the Goods and Special Services (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Clarifying Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions to the Goods and Special Services or to modify contractual terms and conditions by a Change Order.

B. Buyer may issue a Work Change Directive providing for additions, deletions, or revisions to the Goods and Special Services, in which case (1) the Contract Price shall be equitably adjusted to account for any reasonable and necessary credits to Buyer for any such deletion, or for costs (including reasonable overhead and profit) incurred by Seller to accommodate such an addition or revision and (2) the Contract Times shall be equitably adjusted to account for any impact on progress and completion of performance. Such adjustments subsequently shall be duly set forth in a Change Order.

C. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Goods and Special Services may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 5.06.D.3); or

3. Engineer's written interpretation or clarification.

ARTICLE 4 - BONDS AND INSURANCE

4.01 *Bonds*

A. Seller shall furnish to Buyer performance and payment bonds, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Seller's obligations under the Contract Documents. These bonds shall remain in effect until 1) one year after the date when final payment becomes due or 2) completion of the correction period specified in Paragraph 8.03, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Seller shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Seller is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 4.01.B, Seller shall promptly notify Buyer and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 4.01.B and 4.02.

4.02 *Insurance*

A. Seller shall provide insurance of the types and coverages and in the amounts stipulated in the Supplementary Conditions.

B. Failure of Buyer to demand certificates of insurance or other evidence of Seller's full compliance with these insurance requirements or failure of Buyer to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Seller's obligation to maintain such insurance.

C. Upon assignment of this Contract, Seller shall comply with the written request of assignee to provide certificates of insurance to assignee.

D. Buyer does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Seller.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Seller's liability under the indemnities granted to Buyer in the Contract Documents.

4.03 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Buyer or Seller shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

ARTICLE 5 - SELLER'S RESPONSIBILITIES

5.01 *Supervision and Superintendence*

A. Seller shall supervise, inspect, and direct the furnishing of the Goods and Special Services competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform its obligations in accordance with the Contract Documents. Seller shall be solely responsible for the means, methods, techniques, sequences, and procedures necessary to perform its obligations in accordance with the Contract Documents. Seller shall not be responsible for the negligence of Buyer or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure that is shown or indicated in and expressly required by the Contract Documents.

5.02 *Labor, Materials and Equipment*

A. Seller shall provide competent, qualified and trained personnel in all aspects of its performance of the Contract.

B. All Goods, and all equipment and material incorporated into the Goods, shall be as specified, and unless specified otherwise in the Contract Documents, shall be:

1. new, and of good quality;

2. protected, assembled, connected, cleaned, and conditioned in accordance with the original manufacturer's instructions; and

3. shop assembled to the greatest extent practicable.

5.03 *Laws and Regulations*

A. Seller shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of its obligations in accordance with the Contract Documents. Except where otherwise expressly required by such Laws and Regulations, neither Buyer nor Engineer shall be responsible for monitoring Seller's compliance with any Laws or Regulations.

B. If Seller furnishes Goods and Special Services knowing or having reason to know that such furnishing is contrary to Laws or Regulations, Seller shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such performance. It shall not be Seller's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this provision shall not relieve Seller of Seller's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance shall be the subject of an adjustment in Contract Price or Contract Times. If Buyer and Seller are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 9.06.

5.04 *Or Equals*

A. Whenever the Goods, or an item of material or equipment to be incorporated into the Goods, are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier or manufacturer, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item is permitted, other items of material or equipment or material or equipment of other suppliers or manufacturers may be submitted to Buyer for Engineer's review.

1. If in Engineer's sole discretion, such an item of material or equipment proposed by Seller is functionally equal to that named

and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or-equal" item.

2. For the purposes of this paragraph, a proposed item of material or equipment may be considered functionally equal to an item so named only if:

   a. in the exercise of reasonable judgment, Engineer determines that: 1) it is at least equal in quality, durability, appearance, strength, and design characteristics; 2) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole; 3) it has an acceptable record of performance and availability of responsive service; and

   b. Seller certifies that if approved: 1) there will be no increase in any cost, including capital, installation or operating costs, to Buyer; and 2) the proposed item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraph 5.04.A. Engineer will be the sole judge of whether to accept or reject such a proposal or submittal. No "or-equal" will be ordered, manufactured or utilized until Engineer's review is complete, which will be evidenced by an approved Shop Drawing. Engineer will advise Buyer and Seller in writing of any negative determination. Notwithstanding Engineer's approval of an "or-equal" item, Seller shall remain obligated to comply with the requirements of the Contract Documents.

C. *Special Guarantee:* Buyer may require Seller to furnish at Seller's expense a special performance guarantee or other surety with respect to any such proposed "or-equal."

D. *Data:* Seller shall provide all data in support of any such proposed "or-equal" at Seller's expense.

5.05 *Taxes*

A. Seller shall be responsible for all taxes and duties arising out of the sale of the Goods and the furnishing of Special Services. All taxes are included in the Contract Price, except as noted in the Supplementary Conditions.

5.06 *Shop Drawings and Samples*

A. Seller shall submit Shop Drawings and Samples to Buyer for Engineer's review and approval in accordance with the schedule required in Paragraph 2.06.A. All submittals will be identified as required and furnished in the number of copies specified in the Contract Documents. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Seller proposes to provide.

B. Where a Shop Drawing or Sample is required by the Contract Documents, any related work performed prior to Engineer's approval of the pertinent submittal will be at the sole expense and responsibility of Seller.

C. *Submittal Procedures:*

   1. Before submitting each Shop Drawing or Sample, Seller shall have determined and verified:

      a. all field measurements (if required), quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto; and

      b. that all materials are suitable with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the furnishing of Goods and Special Services.

   2. Seller shall also have reviewed and coordinated each Shop Drawing or Sample with the Contract Documents.

   3. Each submittal shall bear a stamp or include a written certification from Seller that Seller has reviewed the subject

submittal and confirmed that it is in compliance with the requirements of the Contract Documents. Both Buyer and Engineer shall be entitled to rely on such certification from Seller.

4. With each submittal, Seller shall give Buyer and Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both in a written communication separate from the submittal and by specific notation on each Shop Drawing or Sample.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples.

2. Engineer's review and approval will be only to determine if the Goods and Special Services covered by the submittals will, after installation or incorporation in the Project, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole.

3. Engineer's review and approval shall not relieve Seller from responsibility for any variation from the requirements of the Contract Documents unless Seller has complied with the requirements of Paragraph 5.06.C.4 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Seller from responsibility for complying with the requirements of Paragraph 5.06.C.1.

E. *Resubmittal Procedures:*

1. Seller shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Seller shall direct specific attention in writing to any revisions other than the corrections called for by Engineer on previous submittals.

5.07 *Continuing Performance*

A. Seller shall adhere to the progress schedule established in accordance with Paragraph 2.06.A., and the Goods shall be delivered and the Special Services furnished within the Contract Times specified in the Agreement.

B. Seller shall carry on furnishing of the Goods and Special Services and adhere to the progress schedule during all disputes or disagreements with Buyer. No furnishing of Goods and Special Services shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraphs 11.03 or 11.04, or as Buyer and Seller may otherwise agree in writing.

5.08 *Seller's Warranties and Guarantees*

A. Seller warrants and guarantees to Buyer that the title to the Goods conveyed shall be proper, its transfer rightful, and free from any security interest, lien, or other encumbrance. Seller shall defend, indemnify, and hold Buyer harmless against any liens, claims, or demands contesting or affecting title of the Goods conveyed.

B. Seller warrants and guarantees to Buyer that all Goods and Special Services will conform with the Contract Documents, and with the standards established by any Samples approved by Engineer. Engineer shall be entitled to rely on Seller's warranty and guarantee. If the Contract Documents do not otherwise specify the characteristics or the quality of the Goods, the Goods shall comply with the requirements of Paragraph 5.02.B.

C. Seller's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, improper modification, improper maintenance, or improper operation by persons other than Seller; or

2. corrosion or chemical attack, unless corrosive or chemically-damaging conditions were disclosed by Buyer in the Contract Documents and the Contract Documents required the Goods to withstand such conditions;

3. use in a manner contrary to Seller's written instructions for installation, operation, and maintenance; or

4. normal wear and tear under normal usage.

D. Seller's obligation to furnish the Goods and Special Services in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Goods and Special Services that are non-conforming, or a release of Seller's obligation to furnish the Goods and Special Services in accordance with the Contract Documents:

1. observations by Buyer or Engineer;

2. recommendation by Engineer or payment by Buyer of any progress or final payment;

3. use of the Goods by Buyer;

4. any acceptance by Buyer (subject to the provisions of Paragraph 8.02.D.1) or any failure to do so;

5. the issuance of a notice of acceptance by Buyer pursuant to the provisions of Article 8;

6. any inspection, test or approval by others; or

7. any correction of non-conforming Goods and Special Services by Buyer.

E. Buyer shall promptly notify Seller of any breach of Seller's warranties or guarantees.

F. Seller makes no implied warranties under this Contract.

5.09 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Seller shall indemnify and hold harmless Buyer and Engineer, and the officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of Seller's obligations under the Contract Documents, provided that any such claim, cost, loss, or damages attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Goods themselves), including the loss of use resulting therefrom, but only to the extent cause by any negligent act or omission of Seller, or any individual or entity directly or indirectly employed by Seller or anyone for whose acts Seller may be liable.

B. In any and all claims against Buyer or Engineer or any of their respective assignees, consultants, agents, officers, directors, members, partners, employees, agents, consultants, contractors, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Seller, any subcontractor, any supplier, or any individual or entity directly or indirectly employed by any of them to furnish any of the Goods and Special Services, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 5.09.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for seller or any such subcontractor, supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Seller under Paragraph 5.09.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, and consultants arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

5.10 *Delegation of Professional Design Services*

A. Seller will not be required to provide professional design services unless such services are specifically required by the Contract Documents or unless such services are required to carry out Seller's responsibilities for furnishing the Goods and

Special Services. Seller shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to the Goods and Special Services are specifically required of Seller by the Contract Documents, Buyer and Engineer will specify all performance and design criteria that such services must satisfy. Seller shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Goods and Special Services designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Buyer and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Buyer and Engineer have specified to Seller all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 5.10, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 5.06.D.2.

E. Seller shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 6 - SHIPPING AND DELIVERY

6.01 *Shipping*

A. Seller shall select the carrier and bear all costs of packaging, transportation, insurance, special handling and any other costs associated with shipment and delivery.

6.02 *Delivery*

A. Seller shall deliver the Goods F.O.B. the Point of Destination in accordance with the Contract Times set forth in the Agreement, or other date agreed to by Buyer and Seller.

B. Seller shall provide written notice to Buyer at least 10 days before shipment of the manner of shipment and the anticipated delivery date. The notice shall also include any instructions concerning special equipment or services required at the Point of Destination to unload and care for the Goods. Seller shall also require the carrier to give Buyer at least 24 hours notice by telephone prior to the anticipated time of delivery.

C. Buyer will be responsible and bear all costs for unloading the Goods from carrier.

D. Buyer will assure that adequate facilities are available to receive delivery of the Goods during the Contract Times for delivery set forth in the Agreement, or another date agreed by Buyer and Seller.

E. No partial deliveries shall be allowed, unless permitted or required by the Contract Documents or agreed to in writing by Buyer.

6.03 *Risk of Loss*

A. Risk of loss and insurable interests transfer from Seller to Buyer upon Buyer's receipt of the Goods.

B. Notwithstanding the provisions of Paragraph 6.03.A, if Buyer rejects the Goods as non-conforming, the risk of loss on such Goods shall remain with Seller until Seller corrects the non-conformity or Buyer accepts the Goods. If rejected Goods remain at the Point of Destination pending modification and acceptance, then Seller shall be responsible for arranging adequate protection and maintenance of the Goods at Seller's expense.

6.04 *Progress Schedule*

A. Seller shall adhere to the progress schedule established in accordance with Paragraph 2.06 as it may be adjusted from time to time as provided below.

1. Seller shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.06) proposed adjustments in

the progress schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 7. Adjustments in Contract Times may only be made by a Change Order.

ARTICLE 7 - CHANGES: SCHEDULE AND DELAY

7.01 *Changes in the Goods and Special Services*

A. Buyer may at any time, without notice to any surety, make an addition, deletion, or other revision to the Contract Documents with respect to the Goods and Services, within the general scope of the Contract, by a Change Order or Work Change Directive. Upon receipt of any such document, Seller shall promptly proceed with performance pursuant to the revised Contract Documents (except as otherwise specifically provided).

B. If Seller concludes that a Work Change Directive issued by Buyer affects the Contract Price or Contract Times, then Seller shall notify Buyer within 15 days after Seller has received the Work Change Directive, and submit written supporting data to Buyer within 45 days after such receipt. If Seller fails to notify Buyer within 15 days, Seller waives any Claim for such adjustment. If Buyer and Seller are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 9.06.

C. Seller shall not suspend performance while Buyer and Seller are in the process of making such changes and any related adjustments to Contract Price or Contract Times.

7.02 *Changing Contract Price or Contract Times*

A. The Contract Price or Contract Times may only be changed by a Change Order.

B. Any Claim for an adjustment in the Contract Price or Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 9.06.

C. If Seller is prevented from delivering the Goods or performing the Special Services within the Contract Times for any unforeseen reason beyond its control and not attributable to its actions or inactions, then Seller shall be entitled to an adjustment of the Contract Times to the extent attributable to such reason. Such reasons include but are not limited to acts or neglect by Buyer, inspection delays, fires, floods, epidemics, abnormal weather conditions, acts of God, and other like matters. If such an event occurs and delays Seller's performance, Seller shall notify Buyer in writing within 15 days of knowing or having reason to know of the beginning of the event causing the delay, stating the reason therefor.

D. Seller shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Seller. Delays attributable to and within the control of Seller's subcontractors or suppliers shall be deemed to be delays within the control of Seller.

E. If Seller is prevented from delivering the Goods or furnishing the Special Services within the Contract Times due to the actions or inactions of Buyer, Seller shall be entitled to any reasonable and necessary additional costs arising out of such delay to the extent directly attributable to Buyer.

F. Neither Buyer nor Seller shall be entitled to any damages arising from delays which are beyond the control of both Buyer and Seller, including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, and other like matters.

ARTICLE 8 - BUYER'S RIGHTS

8.01 *Inspections and Testing*

A. *General:*

1. The Contract Documents specify required inspections and tests. Buyer shall have the right to perform, or cause to be performed, reasonable inspections and require reasonable tests of the Goods at Seller's facility, and at the Point of Destination. Seller shall allow Buyer a reasonable time to perform such inspections or tests.

2. Seller shall reimburse Buyer for all expenses, except for travel, lodging, and subsistence expenses of Buyer's and Engineer's representatives, for inspections and tests specified in the Contract Documents. If as the result of any such specified testing the Goods are determined to be non-conforming, then Seller shall also bear the travel, lodging, and subsistence expenses of Buyer's and Engineer's representatives, and all expenses of re-inspection or retesting.

3. Buyer shall bear all expenses of inspections and tests that are not specified in the Contract Documents (other than any re-inspection or retesting resulting from a determination of non-conformity, as set forth in Paragraph 8.01.A.2 immediately above); provided, however, that if as the result of any such non-specified inspections or testing the Goods are determined to be non-conforming, then Seller shall bear all expenses of such inspections and testing, and of any necessary re-inspection and retesting.

4. Seller shall provide Buyer timely written notice of the readiness of the Goods for all inspections, tests, or approvals which the Contract Documents specify are to be observed by Buyer prior to shipment.

5. Buyer will give Seller timely notice of all specified tests, inspections, and approvals of the Goods which are to be conducted at the Point of Destination.

6. If, on the basis of any inspections or testing, the Goods appear to be conforming, Buyer will give Seller prompt notice thereof. If on the basis of said inspections or testing, the Goods appear to be non-conforming, Buyer will give Seller prompt notice thereof and will advise Seller of the remedy Buyer elects under the provisions of Paragraph 8.02.

7. Neither payments made by Buyer to Seller prior to any tests or inspections, nor any tests or inspections shall constitute acceptance of non-conforming Goods, or prejudice Buyer's rights under the Contract.

B. Inspection on Delivery:

1. Buyer or Engineer will visually inspect the Goods upon delivery solely for purposes of identifying the Goods and general verification of quantities and observation of apparent condition in order to provide a basis for a progress payment. Such visual inspection will not be construed as final or as receipt of any Goods and Special Services that, as a result of subsequent inspections and tests, are determined to be non-conforming.

2. Within ten days of such visual inspection, Buyer shall provide Seller with written notice of Buyer's determination regarding conformity of the Goods. In the event Buyer does not provide such notice, it will be presumed that the Goods appear to be conforming and that Buyer has acknowledged their receipt upon delivery.

3. If, on the basis of the visual inspection specified in Paragraph 8.01.B.1, the Goods appear to be conforming, Buyer's notice thereof to Seller will acknowledge receipt of the Goods.

C. Final Inspection:

1. After all of the Goods have been incorporated into the Project, tested in accordance with such testing requirements as are specified, and are functioning as indicated, Buyer or Engineer will make a final inspection.

2. If, on the basis of the final inspection, the Goods are conforming, Buyer's notice thereof will constitute Buyer's acceptance of the Goods.

3. If, on the basis of the final inspection, the Goods are non-conforming, Buyer will identify the non-conformity in writing.

8.02 *Non-Conforming Goods and Special Services*

A. If, on the basis of inspections and testing prior to delivery, the Goods and Special Services are found to be non-conforming, or if at any time after Buyer has acknowledged receipt of delivery and before the expiration of the correction period described in Paragraph 8.03, Buyer determines that the Goods

and Special Services are non-conforming, then Seller shall promptly, without cost to Buyer and in response to written instructions from Buyer, either correct such non-conforming Goods and Special Services, or, if Goods are rejected by Buyer, remove and replace the non-conforming Goods with conforming Goods, including all work required for reinstallation.

B. Buyer's Rejection of Non-Conforming Goods:

1. If Buyer elects to reject the Goods in whole or in part, Buyer's notice to Seller will describe in sufficient detail the non-conforming aspect of the Goods. If Goods have been delivered to Buyer, Seller shall promptly, and within the Contract Times, remove and replace the rejected Goods.

2. Seller shall bear all costs, losses and damages attributable to the removal and replacement of the non-conforming Goods as provided in Paragraph 8.02.E.

3. Upon rejection of the Goods, Buyer retains a security interest in the Goods to the extent of any payments made and expenses incurred in their testing and inspection.

C. Remedying Non-Conforming Goods and Special Services:

1. If Buyer elects to permit the Seller to modify the Goods to correct the non-comformance, then Seller shall promptly provide a schedule for such modifications and shall make the Goods conforming within a reasonable time.

2. If Buyer notifies Seller in writing that any of the Special Services are non-conforming, Seller shall promptly provide conforming services acceptable to Buyer. If Seller fails to do so, Buyer may delete the Special Services and reduce the Contract Price a commensurate amount.

D. Buyer's Acceptance of Non-Conforming Goods:

Instead of requiring correction or removal and replacement of non-conforming Goods discovered either before or after final payment, Buyer may accept the non-conforming Goods. Seller shall bear all reasonable costs, losses, and damages attributable to Buyer's evaluation of and determination to accept such non-conforming Goods as provided in Paragraph 8.02.E.

E. Seller shall pay all claims, costs, losses, and damages, including but not limited to all fees and charges for re-inspection, retesting and for any engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs arising out of or relating to the non-conforming Goods and Special Services. Seller's obligations shall include the costs of the correction or removal and replacement of the non-conforming Goods and the replacement of property of Buyer and others destroyed by the correction or removal and replacement of the non-conforming Goods, and obtaining conforming Special Services from others.

F. *Buyer's Rejection of Conforming Goods:*

If Buyer asserts that Goods and Special Services are non-conforming and such Goods and Special Services are determined to be conforming, or if Buyer rejects as non-conforming Goods and Special Services that are later determined to be conforming, then Seller shall be entitled to reimbursement from Buyer of costs incurred by Seller in inspecting, testing, correcting, removing, or replacing the conforming Goods and Special Services, including but not limited to fees and charges of engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs associated with the incorrect assertion of non-conformance or rejection of conforming Goods and Special Services.

8.03 *Correction Period*

A. Seller's responsibility for correcting all non-conformities in the Goods and Special Services will extend for a period of one year after the earlier of the date on which Buyer has placed the Goods in continuous service or the date of final payment, or for such longer period of time as may be prescribed by Laws or Regulations or by the terms of any specific provisions of the Contract Documents.

ARTICLE 9 - ROLE OF ENGINEER

9.01 *Duties and Responsibilities*

A. The duties and responsibilities and the limitations of authority of Engineer are set forth in the Contract Documents.

9.02 *Clarifications and Interpretations*

A. Engineer will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents as Engineer may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. Such written clarifications and interpretations will be binding on Buyer and Seller. If either Buyer or Seller believes that a written clarification or interpretation justifies an adjustment in the Contract Price or Contract Times, either may make a Claim therefor.

9.03 *Authorized Variations*

A. Engineer may authorize minor deviations or variations in the Contract Documents by: 1) written approval of specific variations set forth in Shop Drawings when Seller has duly noted such variations as required in Paragraph 5.06.C.4, or 2) a Field Order.

9.04 *Rejecting Non-Conforming Goods and Special Services*

A. Engineer will have the authority to disapprove or reject Goods and Special Services that Engineer believes to be non-conforming. Engineer will also have authority to require special inspection or testing of the Goods or Special Services as provided in Paragraph 8.01 whether or not the Goods are fabricated or installed, or the Special Services are completed.

9.05 *Decisions on Requirements of Contract Documents*

A. Engineer will be the initial interpreter of the Contract Documents and judge of the acceptability of the Goods and Special Services. Claims, disputes and other matters relating to the acceptability of the Goods and Special Services or the interpretation of the requirements of the Contract Documents pertaining to Seller's performance will be referred initially to Engineer in writing with a request for a formal decision in accordance with this paragraph.

B. When functioning as interpreter and judge under this Paragraph 9.05, Engineer will not show partiality to Buyer or Seller and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Engineer pursuant to this Paragraph 9.05 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 10.07) will be a condition precedent to any exercise by Buyer or Seller of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.06 *Claims and Disputes*

A. *Notice*: Written notice of each Claim relating to the acceptability of the Goods and Special Services or the interpretation of the requirements of the Contract Documents pertaining to either party's performance shall be delivered by the claimant to Engineer and the other party to the Agreement within 15 days after the occurrence of the event giving rise thereto, and written supporting data shall be submitted to Engineer and the other party within 45 days after such occurrence unless Engineer allows an additional period of time to ascertain more accurate data.

B. *Engineer's Decision*: Engineer will review each such Claim and render a decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

C. If Engineer does not render a formal written decision on a Claim within the time stated in Paragraph 9.06.B., Engineer shall be deemed to have issued a decision denying the Claim in its entirety 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. Engineer's written decision on such Claim or a decision denying the Claim in its entirety that is deemed to have been issued pursuant to Paragraph 9.06.C, will be final and binding upon Buyer and Seller 30 days after it is issued unless within 30 days of issuance Buyer or Seller appeals Engineer's decision by initiating the mediation of such Claim in accordance with the dispute resolution procedures set forth in Article 13.

E. If Article 13 has been amended to delete the mediation requirement, then Buyer or Seller may appeal Engineer's decision within 30 days of issuance by following the alternative dispute resolution process set forth in Article 13, as amended; or if no such alternative dispute

resolution process has been set forth, Buyer or Seller may appeal Engineer's decision by 1) delivering to the other party within 30 days of the date of such decision a written notice of intent to submit the Claim to a court of competent jurisdiction, and 2) within 60 days after the date of such decision instituting a formal proceeding in a court of competent jurisdiction.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 9.06.

G. The parties agree to endeavor to avoid or resolve Claims through direct, good faith discussions and negotiations whenever practicable. Such discussions and negotiations should at the outset address whether the parties mutually agree to suspend the time periods established in this Paragraph 9.06; if so, a written record of such mutual agreement should be made and jointly executed.

ARTICLE 10 - PAYMENT

10.01 *Applications for Progress Payments*

A. Seller shall submit to Buyer for Engineer's review Applications for Payment filled out and signed by Seller and accompanied by such supporting documentation as is required by the Contract Documents and also as Buyer or Engineer may reasonably require. The timing and amounts of progress payments shall be as stipulated in the Agreement.

1. The first application for Payment will be submitted after review and approval by Engineer of all Shop Drawings and of all Samples required by the Contract Documents.

2. The second Application for Payment will be submitted after receipt of the Goods has been acknowledged in accordance with Paragraph 8.01.B and will be accompanied by a bill of sale, invoice, or other documentation reasonably satisfactory to Buyer warranting that Buyer has rightfully received good title to the Goods from Seller and that, upon payment, the Goods will be free and clear of all liens. Such documentation will include releases and waivers from all parties with viable lien rights. In the case of multiple deliveries of Goods, additional Applications for Payment accompanied by the required documentation will be submitted as Buyer acknowledges receipt of additional items of the Goods.

10.02 *Review of Applications for Progress Payments*

A. Engineer will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Buyer, or return the Application to Seller indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Seller may make the necessary corrections and resubmit the Application.

1. Engineer's recommendation of payment requested in the first Application for Payment will constitute a representation by Engineer, based on Engineer's review of the Application for Payment and the accompanying data, that the Shop Drawings and Samples have been reviewed and approved as required by the Contract Documents and Seller is entitled to payment of the amount recommended.

2. Engineer's recommendation of payment requested in the Application for Payment submitted upon Buyer's acknowledgment of receipt of the Goods will constitute a representation by Engineer, based on Engineer's review of the Application for Payment and the accompanying data Seller is entitled to payment of the amount recommended. Such recommendation will not constitute a representation that Engineer has made a final inspection of the Goods, that the Goods are free from non-conformities, acceptable or in conformance with the Contract Documents, that Engineer has made any investigation as to Buyer's title to the Goods, that exhaustive or continuous inspections have been made to check the quality or the quantity of the Goods beyond the responsibilities specifically assigned to Engineer in the Contract Documents or that there may not be other matters or issues between the parties that might entitle Seller to additional payments by Buyer or Buyer to withhold payment to Seller.

3. Engineer may refuse to recommend that all or any part of a progress payment be made, or Engineer may nullify all or any part of any payment previously recommended if, in Engineer's opinion, such recommendation would be incorrect or if on the basis of subsequently discovered evidence or subsequent inspections or tests Engineer considers such refusal or nullification necessary to protect Buyer from loss because the Contract Price has been reduced, Goods are found to be non-conforming, or Seller has failed to furnish acceptable Special Services.

10.03 *Amount and Timing of Progress Payments*

A. Subject to Paragraph 10.02.A., the amounts of the progress payments will be as provided in the Agreement. Buyer shall within 30 days after receipt of each Application for Payment with Engineer's recommendation pay Seller the amount recommended; but, in the case of the Application for Payment upon Buyer's acknowledgment of receipt of the Goods, said 30-day period may be extended for so long as is necessary (but in no event more than 60 days) for Buyer to examine the bill of sale and other documentation submitted therewith. Buyer shall notify Seller promptly of any deficiency in the documentation and shall not unreasonably withhold payment.

10.04 *Suspension of or Reduction in Payment*

A. Buyer may suspend or reduce the amount of progress payments, even though recommended for payment by Engineer, under the following circumstances:

1. Buyer has reasonable grounds to conclude that Seller will not furnish the Goods or the Special Services in accordance with the Contract Documents, and

2. Buyer has requested in writing assurances from Seller that the Goods and Special Services will be delivered or furnished in accordance with the Contract Documents, and Seller has failed to provide adequate assurances within ten days of Buyer's written request.

B. If Buyer refuses to make payment of the full amount recommended by Engineer, Buyer will provide Seller and Engineer immediate written notice stating the reason for such action and promptly pay Seller any amount remaining after deduction of the amount withheld. Buyer shall promptly pay Seller the amount withheld when Seller corrects the reason for such action to Buyer's satisfaction.

10.05 *Final Application for Payment*

A. After Seller has corrected all non-conformities to the reasonable satisfaction of Buyer and Engineer, furnished all Special Services, and delivered all documents required by the Contract Documents, Engineer will issue to Buyer and Seller a notice of acceptance. Seller may then make application for final payment following the procedure for progress payments. The final Application for Payment will be accompanied by all documentation called for in the Contract Documents, a list of all unsettled Claims, and such other data and information as Buyer or Engineer may reasonably require.

10.06 *Final Payment*

A. If, on the basis of final inspection and the review of the final Application for Payment and accompanying documentation, Engineer is reasonably satisfied that Seller has furnished the Goods and Special Services in accordance with the Contract Documents, and that Seller's has fulfilled all other obligations under the Contract Documents, then Engineer will, within ten days after receipt of the final Application for Payment, recommend in writing final payment subject to the provisions of Paragraph 10.07 and present the Application to Buyer. Otherwise, Engineer will return the Application to Seller, indicating the reasons for refusing to recommend final payment, in which case Seller shall make the necessary corrections and resubmit the Application for payment. If the Application and accompanying documentation are appropriate as to form and substance, Buyer shall, within 30 days after receipt thereof, pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages to which Buyer is entitled.

10.07 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Buyer against Seller, except Claims arising from unsettled liens from non-conformities in the Goods or Special Services appearing after final payment, from Seller's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Seller's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Seller against Buyer (other than those previously made in accordance with the requirements herein and listed by Seller as unsettled as required in Paragraph 10.05.A, and not resolved in writing).

ARTICLE 11 - CANCELLATION, SUSPENSION, AND TERMINATION

11.01 *Cancellation*

A. Buyer has the right to cancel the Contract, without cause, at any time prior to delivery of the Goods by written notice. Cancellation pursuant to the terms of this paragraph shall not constitute a breach of contract by Buyer. Upon cancellation:

1. Buyer shall pay Seller for the direct costs incurred in producing any Goods that Seller has specially manufactured for the Project, plus a fair and reasonable amount for overhead and profit.

2. For Goods that are not specially manufactured for the Project, Seller shall be entitled to a restocking charge of 10 percent of the unpaid Contract Price of such Goods.

11.02 *Suspension of Performance by Buyer*

A. Buyer has the right to suspend performance of the Contract for up to a maximum of ninety days, without cause, by written notice. Upon suspension under this paragraph, Seller shall be entitled to an increase in the Contract Times and Contract Price caused by the suspension, provided that performance would not have been suspended or delayed for causes attributable to Seller.

11.03 *Suspension of Performance by Seller*

A. Subject to the provisions of Paragraph 5.07.B, Seller may suspend the furnishing of the Goods and Special Services only under the following circumstance:

1. Seller has reasonable grounds to conclude that Buyer will not perform its future payment obligations under the Contract; and,

2. Seller has requested in writing assurances from Buyer that future payments will be made in accordance with the Contract, and Buyer has failed to provide such assurances within ten days of Seller's written request.

11.04 *Breach and Termination*

A. Buyer's Breach:

1. Buyer shall be deemed in breach of the Contract if it fails to comply with any material provision of the Contract Documents, including but not limited to:

a. wrongful rejection or revocation of Buyer's acceptance of the Goods,

b. failure to make payments in accordance with the Contract Documents, or

c. wrongful repudiation of the Contract.

2. Seller shall have the right to terminate the Contract for cause by declaring a breach should Buyer fail to comply with any material provisions of the Contract. Upon termination, Seller shall be entitled to all remedies provided by Laws and Regulations.

a. In the event Seller believes Buyer is in breach of its obligations under the Contract, Seller shall provide Buyer with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a

breach has occurred. Buyer shall have seven days from receipt of the written notice declaring the breach (or such longer period of time as Seller may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.

B. Seller's Breach:

1. Seller shall be deemed in breach of the Contract if it fails to comply with any material provision of the Contract Documents, including, but not limited to:

a. failure to deliver the Goods or perform the Special Services in accordance with the Contract Documents,

b. wrongful repudiation of the Contract, or

c. delivery or furnishing of non-conforming Goods and Special Services.

2. Buyer may terminate Seller's right to perform the Contract for cause by declaring a breach should Seller fail to comply with any material provision of the Contract Documents. Upon termination, Buyer shall be entitled to all remedies provided by Laws and Regulations.

a. In the event Buyer believes Seller is in breach of its obligations under the Contract, and except as provided in Paragraph 11.04.B.2.b, Buyer shall provide Seller with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a breach has occurred. Seller shall have seven days from receipt of the written notice declaring the breach (or such longer period of time as Buyer may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.

b. If and to the extent that Seller has provided a performance bond under the provisions of Paragraph 4.01, the notice and cure procedures of that bond, if any, shall supersede the notice and cure procedures of Paragraph 11.04.B.2.a.

ARTICLE 12 – LICENSES AND FEES

12.01 *Intellectual Property and License Fees*

A. Unless specifically stated elsewhere in the Contract Documents, Seller is not transferring any intellectual property rights, patent rights, or licenses for the Goods delivered. However, in the event the Seller is manufacturing to Buyer's design, Buyer retains all intellectual property rights in such design.

B. Seller shall pay all license fees and royalties and assume all costs incident to the use or the furnishing of the Goods, unless specified otherwise by the Contract Documents.

12.02 *Seller's Infringement*

A. Subject to Paragraph 12.01.A, Seller shall indemnify and hold harmless Buyer, Engineer and their officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors from and against all claims, costs, losses, damages, and judgments (including but not limited to all reasonable fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement or alleged infringement of any United States or foreign patent or copyright by any of the Goods as delivered hereunder.

B. In the event of suit or threat of suit for intellectual property infringement, Buyer will promptly notify Seller of receiving notice thereof.

C. Seller shall promptly defend the claim or suit, including negotiating a settlement. Seller shall have control over such claim or suit, provided that Seller agrees to bear all expenses and to satisfy any adverse judgment thereof.

1. If Seller fails to defend such suit or claim after written notice by Buyer, Seller will be bound in any subsequent suit or claim against Seller by Buyer by any factual determination in the prior suit or claim.

2. If Buyer fails to provide Seller the opportunity to defend such suit or claim after written notice by Seller, Buyer shall be barred from any remedy against Seller for such suit or claim.

D. If a determination is made that Seller has infringed upon intellectual property rights of another, Seller may obtain the necessary licenses for Buyer's benefit, or replace the Goods and provide related design and construction as necessary to avoid the infringement at Seller's own expense.

12.03 *Buyer's Infringement*

A. Buyer shall indemnify and hold harmless Seller, and its officers, directors, partners, employees, agents, consultants, contractors, and subcontractors from and against all claims, costs, losses, damages, and judgments (including but not limited to all reasonable fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement or alleged infringement of any United States or foreign patent or copyright caused by Seller's compliance with Buyer's design of the Goods or Buyer's use of the Goods in combination with other materials or equipment in any process (unless intent of such use was known to Seller and Seller had reason to know such infringement would result).

B. In the event of suit or threat of suit for intellectual property infringement, Seller must after receiving notice thereof promptly notify Buyer.

C. Upon written notice from Seller, Buyer shall be given the opportunity to defend the claim or suit, including negotiating a settlement. Buyer shall have control over such claim or suit, provided that Buyer agrees to bear all expenses and to satisfy any adverse judgment thereof.

1. If Buyer fails to defend such suit or claim after written notice by Seller, Buyer will be bound in any subsequent suit or claim against Buyer by Seller by any factual determination in the prior suit or claim.

2. If Seller fails to provide Buyer the opportunity to defend such suit or claim after written notice by Buyer, Seller shall be barred from any remedy against Buyer for such suit or claim.

12.04 *Reuse of Documents*

A. Neither Seller nor any other person furnishing any of the Goods and Special Services under a direct or indirect contract with Seller shall: (1) acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions; or ~~(~~2) reuse any of such Drawings, Specifications, other documents, or copies thereof on any other project without written consent of Buyer and Engineer and specific written verification or adaptation by Engineer. This prohibition will survive termination or completion of the Contract. Nothing herein shall preclude Seller from retaining copies of the Contract Documents for record purposes.

12.05 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, copies of data furnished by Buyer or Engineer to Seller, or by Seller to Buyer or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. The transferring party will correct any errors detected within the 60-day acceptance period.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 13 - DISPUTE RESOLUTION

13.01 *Dispute Resolution Method*

A. Either Buyer or Seller may initiate the mediation of any Claim decided in writing by Engineer under Paragraph 9.06.B or 9.06.C before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the Engineer's decision from becoming final and binding.

B. Buyer and Seller shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the mediation process does not result in resolution of the Claim, then Engineer's written decision under Paragraph 9.06.B or a denial pursuant to Paragraph 9.06.C shall become final and binding 30 days after termination of the mediation unless, within that time period, Buyer or Seller:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. if no dispute resolution process has been provided for in the Supplementary Conditions, delivers to the other party written notice of the intent to submit the Claim to a court of competent jurisdiction, and within 60 days of the termination of the mediation institutes such formal proceeding.

ARTICLE 14 - MISCELLANEOUS

14.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if: 1) delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or 2) if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

14.02 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Point of Destination is located.

B. In the case of any conflict between the express terms of this Contract and the Uniform Commercial Code, as adopted in the state whose law governs, it is the intent of the parties that the express terms of this Contract shall apply.

14.03 *Computation of Time*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation.

14.04 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

14.05 *Survival of Obligations*

A. All representations, indemnifications, warranties and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Goods and Special Services and termination or completion of the Agreement.

14.06 *Entire Agreement*

A. Buyer and Seller agree that this Agreement is the complete and final agreement between them, and supersedes all prior negotiations, representations, or agreements, either written or oral. This Agreement may not be altered, modified, or amended except in writing signed by an authorized representative of both parties.

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions for Procurement Contracts and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

The terms Bid and Bidder are used in the General Conditions. Within these Contract Documents, these terms are revised to Proposer and Proposal.

SC-2.01. Delete Paragraph 2.01 in its entirety.

SC-2.03. Amend the first sentence of Paragraph 2.03.A to read as follows:

> Seller shall obtain copies of the Contract Documents as described in Request for Proposals.

SC-2.04. Delete Paragraph 2.04 in its entirety and add the following:

> 2.04. *Commencement of Contract Times; Notice to Proceed*
>
> > A. The Contract Times will commence to run when Notice to Proceed is issued.

SC-2.06. Amend the first sentence of Paragraph 2.06.A to read as follows:

> Within 20 days after the Contract Times begin to run, Seller shall submit to Buyer and Engineer an acceptable progress schedule of activities, including at a minimum, Shop Drawing and Sample submittals, tests, and deliveries as required by the Contract Documents.

SC-4.01.A. Delete Paragraph 4.01.A in its entirety and add the following:

> 4.01 Bonds.
>
> > A. Seller shall furnish to Buyer performance and payment bonds, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Seller's obligations under the Contract Documents. These bonds shall remain in effect throughout warranty period.

SC-4.01.B. Add the following language at the end of Paragraph 4.01.B:

Surety and insurance companies from which the bonds and insurance for this Project are purchased shall have a Best's rating of no less than A:VII, in addition to the other requirements specified herein.

SC-4.02. Add the following new paragraphs immediately after Paragraph 4.02.E:

4.02.F. Seller shall purchase and maintain the following liability and other insurance for the furnishing of Goods and Special Services to provide protection from claims set forth below which may arise out of or result from Seller's furnishing of the Goods or Special Services and Seller's other obligations under the Contract Documents, whether the furnishing of Goods and Special Services, or other obligations are to be performed by Seller, any subcontractor or supplier, or by anyone directly or indirectly employed by any of them to furnish the Goods and Special Services, or by anyone for whose acts any of them may be liable:

4.02.F.1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

4.02.F.2. claims for damages because of bodily injury, occupational sickness or disease, or death of Seller's employees;

4.02.F.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Seller's employees;

4.02.F.4. claims from damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Seller, or (ii) by any other person for any other reason;

4.02.F.5. claims for damages, other than to the Goods, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom which may arise from or in connection with the performance of the work by Supplier; and

4.02.F.6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.

4.02.F.7. claims as described in Article 4.02.H.

4.02.G. The policies of insurance required by this Paragraph 4.02 to be purchased and maintained shall:

4.02.G.1. with respect to insurance required by Paragraphs SC-4.02.F.3. through SC-4.02.F.6. inclusive, include as additional insured (subject to any customary exclusion in respect of professional liability):

4.02.G.1.a. City of San Luis Obispo, 990 Palm Street, San Luis Obispo, CA 93401.

4.02.G.1.b. CH2M HILL Engineers, Inc., 9191 South Jamaica Street, Englewood, CO 80112.

4.02.G.2. all of whom shall be listed as additional insured, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

4.02.G.3. include at least the specific coverages and be written for not less than limits of liability provided below or required by Laws or Regulations, whichever is greater;

4.02.G.4. include completed operations insurance;

4.02.G.5. include contractual general liability insurance covering Seller's indemnity obligations under Paragraphs 5.09 and 12.02;

4.02.G.6. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice has been given to Buyer and Seller, and to each other additional insured identified in these Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by Seller pursuant to Paragraph SC-4.02.I will so provide);

4.02.G.7. remain in effect at least until final payment and at all times thereafter when Seller may be correcting, removing, or replacing nonconforming Goods in accordance with Paragraph 8.03;

4.02.G.8. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least 2 years after final payment (and Seller shall furnish Buyer and each other additional insured identified in these Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Buyer and any such additional insured of continuation of such insurance at final payment and 1 year thereafter); and

4.02.G.9. with respect to any delegation of professional design services to Seller pursuant to Paragraph 5.10 of the General Conditions, include professional liability coverage by endorsement or otherwise.

4.02.H. Without limiting Seller's indemnification of Buyer, and prior to commencement of performance of the Agreement for Goods and Special Services, Seller shall obtain, provide and maintain at its own expense during the term of this Agreement and as described herein, policies of insurance of the type and amounts described below and in a form satisfactory to Buyer.

4.02.H.1. General liability insurance. Seller shall maintain commercial general liability insurance with coverage at least as broad as Insurance Services Office form CG 00 01, in an amount not less than $2,000,000 per occurrence, $4,000,000 general aggregate, for bodily injury, personal injury, and property damage, and a $2,000,000 completed operations aggregate. The policy must include contractual liability that has not been amended. Any endorsement restricting standard ISO "insured contract" language will not be accepted.

4.02.H.2. Automobile liability insurance. Seller shall maintain automobile insurance at least as broad as Insurance Services Office form CA 00 01 covering bodily injury and property damage for all activities of the Seller arising out of or in connection with Work to be performed under this Agreement, including coverage for any owned, hired, non-owned or rented vehicles, in an amount not less than $1,000,000 combined single limit for each accident.

4.02.H.3. Umbrella or excess liability insurance. Seller shall obtain and maintain an umbrella or excess liability insurance policy that will provide bodily injury, personal injury and property damage liability coverage at least as broad as the primary coverages set forth above, including commercial general liability and employer's liability, in an amount not less than $5 million. Such policy or policies shall include the following terms and conditions:

- A drop down feature requiring the policy to respond in the event that any primary insurance that would otherwise have applied proves to be uncollectable in whole or in part for any reason;
- Pay on behalf of wording as opposed to reimbursement;
- Concurrency of effective dates with primary policies; and
- Policies shall "follow form" to the underlying primary policies.
- Insureds under primary policies shall also be insureds under the umbrella or excess policies.

4.02.H.4. Workers' compensation insurance. Seller shall maintain Workers' Compensation Insurance (Statutory Limits) and Employer's Liability Insurance (with limits of at least $1,000,000) for Seller 's employees in accordance with the laws of the State of California, Section 3700 of the Labor Code In addition, Seller shall require each subcontractor to similarly maintain Workers' Compensation Insurance and Employer's Liability Insurance in accordance with the laws of the State of California, Section 3700 for all of the subcontractor's employees.

Seller shall submit to Buyer, along with the certificate of insurance, a Waiver of Subrogation endorsement in favor of Buyer, its officers, agents, employees and volunteers.

4.02.H.5. Pollution liability insurance. Environmental Impairment Liability Insurance shall be written on a Contractor's Pollution Liability form or other form acceptable to Buyer providing coverage for liability arising out of sudden, accidental and gradual pollution and remediation. The policy limit shall be no less than $1,000,000 dollars per claim and in the aggregate. All activities contemplated in this agreement shall be specifically scheduled on the policy as "covered operations."

Products/completed operations coverage shall extend a minimum of 3 years after project completion. Coverage shall be included on behalf of the insured for covered claims arising out of the actions of independent contractors. If the insured is using subcontractors, the Policy must include work performed "by or on behalf" of the insured. Policy shall contain no language that would invalidate or remove the insurer's duty to defend or indemnify for claims or suits expressly excluded from coverage. Policy shall specifically provide for a duty to defend on the part of the insurer. The Buyer, its officials, officers, agents, and employees, shall be included as insureds under the policy.

4.02.H.6. Professional liability (errors and omissions) insurance. Seller shall maintain professional liability insurance that covers the Special Services to be performed in connection with this Agreement, in the minimum amount of $1,000,000 per claim and in the aggregate. Any policy inception date, continuity date, or retroactive date must be before the effective date of this agreement and Seller agrees to maintain continuous coverage through a period no less than three years after completion of the services required by this agreement.

4.02.H.7. Other provisions and requirements

4.02.H.7.a. Proof of insurance. Seller shall provide certificates of insurance to Buyer as evidence of the insurance coverage required herein, along with a waiver of subrogation endorsement for workers' compensation. Insurance certificates and endorsements must be approved by Buyer's risk manager prior to commencement of performance. Current certification of insurance shall be kept on file with Buyer at all times during the term of this contract. Buyer

reserves the right to require complete, certified copies of all required insurance policies, at any time.

4.02.H.7.b. Duration of coverage. Seller shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property, which may arise from or in connection with the performance of the Work hereunder by Seller, his agents, representatives, employees or subcontractors. Seller must maintain general liability and umbrella or excess liability insurance for as long as there is a statutory exposure to completed operations claims. Buyer and its officers, officials, employees, and agents shall continue as additional insureds under such policies.

4.02.H.7.c. Primary/noncontributing. Coverage provided by Seller shall be primary and any insurance or self-insurance procured or maintained by Buyer shall not be required to contribute with it. The limits of insurance required herein may be satisfied by a combination of primary and umbrella or excess insurance. Any umbrella or excess insurance shall contain or be endorsed to contain a provision that such coverage shall also apply on a primary and non-contributory basis for the benefit of Buyer before the Buyer's own insurance or self-insurance shall be called upon to protect it as a named insured.

4.02.H.7.d. Buyer's rights of enforcement. In the event any policy of insurance required under this Agreement does not comply with these requirements or is canceled and not replaced, Buyer has the right but not the duty to obtain the insurance it deems necessary and any premium paid by Buyer will be promptly reimbursed by Seller or Buyer will withhold amounts sufficient to pay premium from Seller payments. In the alternative, Buyer may cancel this Agreement.

4.02.H.7.e. Acceptable insurers. All insurance policies shall be issued by an insurance company currently authorized by the Insurance Commissioner to transact business of insurance or is on the List of Approved Surplus Line Insurers in the State of California, with an assigned policyholders' Rating of A- (or higher) and Financial Size Category Class VII (or larger) in accordance with the latest edition of Best's Key Rating Guide, unless otherwise approved by the Buyer's Risk Manager.

4.02.H.7.f. Waiver of subrogation. All insurance coverage maintained or procured pursuant to this agreement shall be endorsed to waive subrogation against Buyer, its elected or appointed officers, agents, officials, employees and volunteers or shall specifically allow Seller or others providing insurance evidence in compliance with these specifications to waive their right of recovery prior to a loss. Seller hereby

waives its own right of recovery against Buyer, and shall require similar written express waivers and insurance clauses from each of its subconsultants.

4.02.H.7.g. Enforcement of contract provisions (non estoppel). Seller acknowledges and agrees that any actual or alleged failure on the part of the Buyer to inform Seller of non-compliance with any requirement imposes no additional obligations on the Buyer nor does it waive any rights hereunder.

4.02.H.7.h. Requirements not limiting. Requirements of specific coverage features or limits contained in this Section are not intended as a limitation on coverage, limits or other requirements, or a waiver of any coverage normally provided by any insurance. Specific reference to a given coverage feature is for purposes of clarification only as it pertains to a given issue and is not intended by any party or insured to be all inclusive, or to the exclusion of other coverage, or a waiver of any type. If the Seller maintains higher limits than the minimums shown above, the Buyer requires and shall be entitled to coverage for the higher limits maintained by the Seller. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the Buyer.

4.02.H.17.i. Notice of cancellation. Seller agrees to oblige its insurance agent or broker and insurers to provide to Buyer with a thirty (30)-day notice of cancellation (except for nonpayment for which a ten (10)-day notice is required) or nonrenewal of coverage for each required coverage.

4.02.H.7.j. Additional insured status. General liability policies shall provide or be endorsed to provide that Buyer and its officers, officials, employees, agents, and volunteers shall be additional insureds under such policies. This provision shall also apply to any excess/umbrella liability policies.

4.02.H.7.k. Prohibition of undisclosed coverage limitations. None of the coverages required herein will be in compliance with these requirements if they include any limiting endorsement of any kind that has not been first submitted to Buyer and approved of in writing.

4.02.H.7.l. Separation of insureds. A severability of interests provision must apply for all additional insureds ensuring that Seller’s insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the insurer’s limits of liability. The policy(ies) shall not contain any cross-liability exclusions.

4.02.H.7.m. Pass through clause. Seller agrees to ensure that its subconsultants, subcontractors, and any other party involved with the project who is brought onto or involved in the project by Seller, provide the same minimum insurance coverage and endorsements required of Seller. Seller agrees to monitor and review all such coverage and assumes all responsibility for ensuring that such coverage is provided in conformity with the requirements of this section. Seller agrees that upon request, all agreements with consultants, subcontractors, and others engaged in the project will be submitted to Buyer for review.

4.02.H.7.n. Buyer's right to revise requirements. The Buyer reserves the right at any time during the term of the contract to change the amounts and types of insurance required by giving the Seller a ninety (90)-day advance written notice of such change. If such change results in substantial additional cost to the Seller, the Buyer and Seller may renegotiate Seller's compensation.

4.02.H.7.o. Self-insured retentions. Any self-insured retentions must be declared to and approved by Buyer. Buyer reserves the right to require that self-insured retentions be eliminated, lowered, or replaced by a deductible. Self-insurance will not be considered to comply with these specifications unless approved by Buyer.

4.02.H.7.p. Timely notice of claims. Seller shall give Buyer prompt and timely notice of claims made or suits instituted that arise out of or result from Seller's performance under this Agreement, and that involve or may involve coverage under any of the required liability policies.

4.02.H.7.q. Additional insurance. Seller shall also procure and maintain, at its own cost and expense, any additional kinds of insurance, which in its own judgment may be necessary for its proper protection and prosecution of the Work.

4.02.I. Seller shall deliver to Buyer, with copies to each additional insured identified in these Supplementary Conditions, certificates of insurance (and other evidence requested by Buyer or any other additional insured) which Seller is required to purchase and maintain.

4.02.J. If Buyer has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained on the basis of nonconformance with the Contract Documents, Buyer shall notify Seller in writing within 10 days after receipt of the certificates. Seller shall provide such additional information in respect to insurance as Buyer shall reasonably request.

SC-5.01. Delete Paragraph 5.01 in its entirety and add the following:

5.01. *Supervision and Superintendence.*

A. Seller shall supervise, inspect, and direct the furnishing of the Goods and Special Services competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform its obligations in accordance with the Contract Documents. Seller shall be solely responsible for the means, methods, techniques, sequences, and procedures necessary to perform its obligations in accordance with the Contract Documents.

SC-5.03.C. Delete Paragraph 5.03.C in its entirety.

SC-5.04.A. Delete Paragraph 5.04.A in its entirety and replace with the following:

5.04.A. Pursuant to Public Contract Code Section 3400(b) the City may make a finding that is described in Instructions to Proposers that designates certain products, things, or services by specific brand or trade name. Unless specifically designated in the Contract Documents, whenever any material, process, or article is indicated or specified by grade, patent, or proprietary name or by name of manufacturer, such specifications shall be deemed to be used for the purpose of facilitating the description of the material, process or article desired and shall be deemed to be followed by the words "or-equal." Supplier may, unless otherwise stated, offer for substitution any material, process or article which is substantially equal or better in every respect to what is specified in the Contract Documents.

SC-5.06. Add the following new paragraphs immediately after Paragraph 5.06.E:

SC-5.06.F. Seller shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples, or other items requiring approval and Seller shall reimburse Buyer for Engineer's charges for such time.

SC-5.06.G. In the event that Seller requests a change of a previously approved item, Seller shall reimburse Buyer for Engineer's charges for its review time unless the need for such change is beyond the control of Seller.

SC-5.08.C.1. Delete Paragraph 5.08.C.1 in its entirety and add the following:

5.08.C.1. abuse, improper modification, improper maintenance, or improper operation or operation not in accordance with the Contract Documents or written information provided by Seller; or

SC-5.09.A. Delete Paragraph 5.09.A in its entirety and add the following:

5.09.A. To the fullest extent permitted by Laws and Regulations, Seller shall indemnify, defend and hold harmless Buyer and Engineer, and the officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of Seller's obligations under the Contract Documents, provided that any such claim, cost, loss, or damages attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Goods themselves), including the loss of use resulting therefrom, is caused by any negligent act or omission of Seller, or any individual or entity directly or indirectly employed by Seller or anyone for whose acts Seller may be liable.

5.09.B. Notwithstanding the foregoing, to the extent Supplier’s work is subject to Civil Code Section 2782.8, the above indemnity shall be limited, to the extent required by Civil Code Section 2782.8, to claims that arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of the Supplier.

SC-6.02.B. Delete Paragraph 6.02.B in its entirety and add the following:

6.02.B. Seller shall provide written notice to Buyer at least 30 days before shipment of the manner of shipment and the anticipated delivery date. The notice shall also include any instructions concerning special equipment or services required at the Point of Destination to unload and care for the Goods. Seller shall also require the carrier to give Buyer at least 36 hours’ notice by telephone prior to the anticipated time of delivery.

SC-7.01.B. Delete Paragraph 7.01.B in its entirety and add the following:

7.01.B. If Seller concludes that a Work Change Directive issued by Buyer affects the Contract Price or Contract Times, then Seller shall notify Buyer within 5 days after Seller has received the Work Change Directive and prior to performing any work under the Work Change Directive, and submit written supporting data to Buyer within 5 days after such receipt. If Seller fails to notify Buyer within 5 days, Seller waives any Claim for such adjustment. If Buyer and Seller are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 9.06.

SC-8.01.A.1. Delete Paragraph 8.01.A.1 in its entirety and add the following:

> 8.01.A.1. The Contract Documents specify required inspections and tests. Buyer shall have the right to perform, or cause to be performed, inspections and require specified tests of the Goods at Seller's facility, and at the Point of Destination. Seller shall allow Buyer a reasonable time to perform such inspections or tests.

SC-8.01.A. Add the following immediately after Paragraph 8.01.A.7:

> 8.01.A.8. Seller should perform such inspections and testing in accordance with Buyer's directions.

SC-8.01.B.2. Delete Paragraph 8.01.B.2 in its entirety.

SC-8.02.B.3. Delete Paragraph 8.02.B.3 in its entirety.

SC-8.03.A. Delete Paragraph 8.03.A in its entirety and add the following:

> 8.03.A. Seller's responsibility for correcting all nonconformities in the Goods and Special Services will extend for the warranty period as specified in the Proposal Form or for such longer period of time as may be prescribed by Laws or Regulations or by the terms of any warranty provisions of the Contract Documents.

SC-9.05.B. Delete Paragraph 9.05.B in its entirety.

SC-9.06. Delete Paragraph 9.06.A and add the following:

> Written notice of each Claim (as defined in SC-13.01, below) shall be delivered to Engineer and Buyer within 5 days after the occurrence of the event giving rise thereto, and written supporting data shall be submitted to Engineer and Buyer within 15 days after such occurrence unless Engineer allows an additional period of time to ascertain more accurate data. If Seller fails to give notice within 5 days Seller waives any claim for adjustment.

SC-9.06. Delete Paragraphs 9.06.B through F in their entirety.

SC-10.04.B. Delete Paragraph 10.04.B in its entirety and add the following:

> 10.04.B. If Buyer refuses to make payment of the full amount recommended by Engineer, Buyer will provide Seller and Engineer prompt written notice stating the reason for such action and promptly pay Seller any amount remaining after deduction of the amount withheld. Buyer shall promptly pay Seller the amount withheld when Seller corrects the reason for such action to Buyer's satisfaction.

SC-10.07. Delete Paragraph 10.07.A in its entirety.

SC-11.03. Delete Paragraph 11.03 in its entirety and replace with the following:

> 11.03. Seller may suspend the furnishing of the Goods and Special Services only in the event that any undisputed payment due the Seller, per the terms of the Contract Documents, is more than 30 days past due.

SC-11.04. Delete Paragraphs 11.04.A.1.a and .c in their entirety.

SC-11.04. Delete Paragraph 11.04.A.2 in its entirety.

SC-12. Delete 12.01.A. in its entirety and replace with the following:

> Seller shall, and hereby does, grant to Buyer, a non-exclusive, non-transferable, royalty free license to use all the intellectual property included in the Special Goods and Services to the extent necessary and solely for Buyer's use of the Goods, unless specified otherwise by the Contract Documents. Seller shall provide a backup copy of the PLC software upon execution of a mutually agreeable confidentiality agreement.

SC-12.03. Delete Paragraph 12.03 in its entirety.

SC-12.05.A. Delete Paragraph 12.05 in its entirety and replace with the following:

> 12.05.A. Unless otherwise stated in the Supplementary Conditions, copies of data furnished by Buyer to Seller, or by Seller to Buyer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

SC-13. Delete Article 13 in its entirety and replace with the following:

Article 13 - RESOLUTION OF CLAIMS.

13.01 *Resolution of Claims.*

A. In accordance with Public Contract Code Sections 20104 et seq. and other Applicable Law, public works claims of $375,000 or less which arise between the Contractor and City shall be resolved under the following statutory procedure unless City has elected to resolve the dispute pursuant to Public Contract Code Section 10240 et seq.

B. All Claims shall be submitted in writing and accompanied by substantiating documentation. Claims must be filed on or before the date of final payment unless other notice requirements are provided in the contract. As used in this section, "Claim" means a separate demand by the Contractor for (1) a time extension, (2) payment of money or damages arising from work done by or on

behalf of the Contractor and payment of which is not otherwise expressly provided for or the Contractor is not otherwise entitled, or (3) an amount the payment of which is disputed by City.

C. Claims Under $50,000. City shall respond in writing to a Claim within 45 days of receipt of the Claim, or City may request, in writing, within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to defenses or claims City may have. If additional information is needed thereafter, it shall be provided upon mutual agreement of City and the Contractor. City's written response shall be submitted 15 days after receiving the additional documentation, or within the same period of time taken by the Contractor to produce the additional information, whichever is greater.

D. Claims over $50,000 but less than or equal to $375,000. City shall respond in writing within 60 days of receipt, or, may request in writing within 30 days of receipt of the Claim, any additional documents supporting the Claim or relating to defenses or claims City may have against the Contractor. If additional information is needed thereafter, it shall be provided pursuant to mutual agreement between City and the Contractor. City's response shall be submitted within 30 days after receipt of the further documents, or within the same period of time taken by the Contractor to produce the additional information or documents, whichever is greater. The Contractor shall make these records and documents available at all reasonable times, at no cost to City.

E. The Contractor will submit every Claim in the following format:

1. Summary of entitlement to Claim and amount of money or time requested in Claim and provisions of the Contract Documents on which the Claim is made.

2. List of all documents Contractor contends support the Claim, including but not limited to the following:

I. Contract Documents.

II. Clarifications (Requests for Information).

III. Schedules.

IV. Other materials, such as job diaries, invoices, time and material cost records, photographs, videos, etc.

V. Chronology of events and correspondence.

VI. Analysis of Claim merit.

VII. Analysis of Claim amount.

VIII. Time impact analysis in CPM format.

IX. All documents, other than Contract Documents, identified in B, above.

X. Cover letter and certification of the Claim, including any claims from subcontractors or suppliers of any tier, in accordance with the California False Claims Act, Government Code Sections 12650 et seq.

F. Notwithstanding the foregoing, all public works claims between the Contractor and City shall be resolved pursuant to the procedures set forth in Public Contract Code Section 9204. City will provide a written response to the Contractor identifying what portion of the Claim is disputed and what portion is undisputed within 45 days of receipt of the Claim, unless the parties mutually agree to extend the time for response. If City does not respond within the 45-day time period, or as extended by mutual agreement, the Claim shall be deemed rejected in its entirety.

G. If the Contractor disputes City's response, or if City fails to respond within the statutory time period(s), the Contractor may notify City within 15 days of the receipt of the response or the failure to respond, and demand an informal conference to meet and confer for settlement. Upon such demand, City shall schedule a meet and confer conference within 30 days.

H. Within 10 business days following the conclusion of the meet and confer conference, if the Claim or any portion thereof remains in dispute, City shall provide the Contractor with a written statement identifying the portion of the Claim that remains in dispute and the portion that is undisputed. Any portion of the Claim that remains in dispute shall be submitted to nonbinding mediation. The selection of the mediator shall be in accordance with Public Contract Code Section 9204 and City and the Contractor shall equally share the associated mediator fees. Each party will be responsible for its own attorney's fees and other costs of participating in the meet and confer conference.

I. The Contractor must comply with the claims filing procedures set forth in Government Code section 900 et seq. for any Claim or any portion thereof that remains in dispute, after the meet and confer conference. For purposes of those provisions, the time within which a Claim must be filed under Government Code section 900 et seq. shall be tolled from the time the Contractor submits the written Claim until the date the Claim is denied, including any time utilized for the meet and confer conference.

J. Submission of a Claim, properly certified, with all required supporting documentation, and written rejection or denial of all or part of the Claim by City, is a condition precedent to any action, proceeding, litigation, suit, general conditions claim, or demand for arbitration by Contractor.

K. Government Code Claim. In addition to any and all contract requirements pertaining to notices of and requests for compensation or payment for Claims, extra work, disputed work, construction claims and/or changed conditions, the Contractor must comply with the claim procedures set forth in Government Code Section 900 et seq. prior to filing any lawsuit against City. Such Government Code claims and any subsequent lawsuit based upon the Government Code claims shall be limited to those matters that remain unresolved after all procedures pertaining to Claims, extra work, disputed work, construction claims, and/or changed conditions have been followed by Contractor. If no such Government Code claim is submitted, or if the contract requirements for Claims are not otherwise satisfied as set forth above, Contractor shall be barred from bringing and maintaining a lawsuit against City.

L. Venue. Venue for any litigation arising out of or relating to this Agreement shall be San Luis Obispo County, California.

SC-14.02. Delete Paragraph 14.02 in its entirety and replace with the following:

14.02. The laws of the State of California, without regard to conflict of laws principles, shall govern the interpretation and enforcement of this Agreement. Venue for any disputes or legal actions shall be in San Luis Obispo County.

END OF SECTION

PART 4

SPECIFICATIONS

SECTION 01 26 01
CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 CONTRACT MODIFICATION PROCEDURES

A. Proposal Request:

1. Buyer may, in anticipation of ordering an addition, deletion, or revision to the Goods or Special Services, request Seller to prepare a detailed proposal of cost and times to perform contemplated change.
2. Proposal request will include reference number for tracking purposes and detailed description of and reason for proposed change, and such additional information as appropriate and as may be required for Seller to accurately estimate cost and time impact on Project.
3. Proposal request is for information only; Seller is neither authorized to execute proposed change nor to stop work in progress as result of such request.
4. Seller's written proposal shall be transmitted to Engineer promptly, but not later than 14 days after Seller's receipt of Buyer's written request. Proposal shall remain firm for a maximum period of 45 days after receipt by Engineer.
5. Buyer's request for proposal or Seller's failure to submit such proposal within required time period will not justify a claim for an adjustment in Contract Price or Contract Times (or Milestones).

B. Change Orders:

1. Procedure:
   a. Engineer will prepare five copies of proposed Change Order and transmit such with Engineer's written recommendation (Change Order only) and request to Seller for signature.
   b. Seller shall, upon receipt, either: (i) promptly sign copies, retaining one for its file, and return remaining four copies to Engineer for Buyer's signature, or (ii) return unsigned four copies with written justification for not executing Change Order.
   c. Engineer will, upon receipt of Seller signed copies, promptly forward Engineer's written recommendation and partially executed four copies for Buyer's signature, or if Seller fails to execute Change Order, Engineer will promptly so notify Buyer and transmit Seller's justification to Buyer.
   d. Upon receipt of Seller-executed Change Order, Buyer will promptly either:

1) Execute Change Order, retaining one copy for its file and returning three copies to Engineer, or
2) Return to Engineer unsigned copies with written justification for not executing Change Order.

e. Upon receipt of Buyer-executed Change Order, Engineer will transmit two copies to Seller and retain one copy, or if Buyer fails to execute Change Order, Engineer will promptly so notify Seller and transmit Buyer's justification to Seller.

f. Upon receipt of Buyer-executed Change Order, Seller shall:
1) Perform work covered by Change Order.
2) Revise progress schedule to reflect changes in Contract Times, if any, and to adjust times for other items of Project affected by change.

2. In signing a Change Order, Buyer and Seller acknowledge and agree that:
a. Stipulated compensation (Contract Price or Contract Times, or both) set forth includes payment for (i) cost of the work covered by Change Order, (ii) Seller's fee for overhead and profit, (iii) interruption of progress schedule, (iv) delay and impact, including cumulative impact, on other work under the Contract Documents, and (v) extended overheads.
b. Change Order constitutes full mutual accord and satisfaction for the change to the Goods or Special Services.
c. Unless otherwise stated in Change Order, all requirements of the original Contract Documents apply to the Goods or Special Services covered by Change Order.

C. Work Change Directive:

1. Engineer will:
a. Initiate, including a description of the Work involved and any attachments.
b. Affix signature, demonstrating Engineer's recommendation.
c. Transmit five copies to Owner for authorization.
2. Owner will:
a. Affix signature, demonstrating approval of the changes involved.
b. Return four copies to Engineer, who will retain one copy, send one copy to the Resident Project Representative or other field representative, and forward two copies to Contractor.
3. Upon completion of Work covered by the Work Change Directive or when final Contract Times and Contract Price are determined, Contractor shall submit documentation for inclusion in a Change Order.
4. Contractor's documentation shall include but not be limited to:
a. Appropriately detailed records of Work performed to enable determination of value of the Work.

b. Full information required to substantiate resulting change in Contract Times and Contract Price for Work. On request of Engineer, provide additional data necessary to support documentation.
c. Support data for Work performed on a unit price or Cost of the Work basis with additional information such as:
    1) Dates Work was performed, and by whom.
    2) Time records, wage rates paid, and equipment rental rates.
    3) Invoices and receipts for materials, equipment, and subcontracts, all similarly documented.

5. Effective Date of Work Change Directive: Date of signature by Owner, unless otherwise indicated thereon.

1.02 CLAIMS

A. Include, at a minimum:

1. Specific references including (i) Drawing numbers, (ii) Specification section and article/paragraph number, and (iii) Submittal number, date reviewed, Engineer's comment, as applicable, with appropriate attachments.
2. Stipulated facts and pertinent documents, including photographs and statements.
3. Interpretations relied upon.
4. Description of (i) nature and extent of claim, (ii) who or what caused situation, (iii) impact to work and work of others, and (iv) discussion of claimant's justification for requesting change to price or times or both.
5. Estimated adjustment in price claimant believes it is entitled to with full documentation and justification.
6. Requested Change in Contract Times: Include at least (i) progress schedule documentation showing logic diagram for request, (ii) documentation that float times available for work have been used, and (iii) revised activity logic with durations including sub-network logic revisions, duration changes, and other interrelated schedule impacts, as appropriate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Seller's standard form.
2. Schedule of Estimated Progress Payments:
   a. Submit with initially acceptable Schedule of Values.
   b. Submit adjustments thereto with Application for Payment.
3. Application for Payment.
4. Final Application for Payment.

1.02 ALLOWANCE FOR SPARE PARTS AND UNFORESEEN DESIGN CHANGES AND SCOPE MODIFICATIONS ("ALLOWANCE")

A. "Allowance" means an amount of Two Hundred Thousand Dollars ($200,000) which has been set aside by Buyer, Schedule A, Item A.8 in the Bid Form. The "Allowance" may be used to fund additional scope of services as identified by the Buyer. The Allowance is included in the Bid Form as a Buyer's allowance for additional materials and services which may be selected by the Buyer. Seller will not be entitled to payment of any portion of the Allowance without Buyer's express written consent. Any portion of the Allowance that is not expressly approved for payment to Seller will remain with Buyer, and Seller shall have no claim to that portion of the Allowance.

B. Upon request from the Buyer, the Seller shall provide additional service or products. For any such work, the Seller shall first furnish a written scope and cost estimate to the Buyer. The Buyer shall approve the scope and cost estimate provided by the Seller in writing before the Seller proceeds with the work. A budgetary amount of $200,000 has been included as an "Allowance" for this work. The "Allowance" shall be monitored separately by the Seller and shall not be used for any other purpose than specifically authorized.

C. Consult with Engineer in selection of products or services. Obtain proposals from Suppliers and installers, and offer recommendations.

D. Submit, with application for payment, invoice showing date of purchase, from whom the purchase was made, the date of delivery of the product or service, and the price, including delivery to the Site and applicable taxes.

1.03 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Engineer, provide support documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Proposal Form.

D. Lump Sum Work:

1. Reflect Schedule of Values format included in conformed Proposal Form, specified allowances, alternates, and equipment selected by Owner, as applicable.
2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, facility startup, and contract closeout separately.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

1.04 PAYMENT

A. Payments: Progress payments shall be made in the manner specified herein. The Contract for the Membrane Equipment System will be assigned to the Contractor. The manner of payment will be different before this Contract is assigned than it will be after assignment.

1. Payment Prior to Assignment of Contract: Prior to the assignment of the Contract to the Contractor, the Owner will pay the Seller directly according to the payment schedule. The Seller shall submit a properly completed Application for Payment directly to the Owner for this amount. Upon receipt of this Application for Payment, the Owner will pay the Seller the full amount stated in such application within 30 days.
2. Payment after Assignment of Contract: After this Contract has been assigned to the Contractor, progress payments shall be made by the Owner to the Contractor. Application for Payment for the remaining portion of this Contract will be made by the Seller to the Contractor. The Contractor will then incorporate the application into the appropriate Application for Payment for construction at the San Luis Obispo Water Resource Recovery Facility. The Contract between the Contractor and the Owner will include provisions which will require the Contractor to pay the Seller within 30 days of receipt of payment from the Owner.

3. Documentation:
   a. The Contract between the Contractor and the Owner will include the following provisions:
      1) If payment is requested for materials and equipment not incorporated in the Work, but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Progress Payment shall be accompanied by such data, satisfactory to the Owner, as will establish Owner's title to the material and protect his interest therein, including applicable insurance. Payment for such materials and equipment shall be based only upon the actual cost of the materials and equipment to the Contractor and shall not include any overhead and profit to the Contractor.
4. Payment Schedule: The Buyer will pay for the equipment based on the following schedule:

Milestone Completion	Percent of Supplier's Lump Sum Proposal Amount to be Paid by Buyer	Milestone Completion Deadline (days past Notice to Proceed)	Amount of Liquidated Damages Assessable by Buyer
System Integration Workshop	0.1%	10	$500/day
Design Deliverable No. 1	0.4%	30	$500/day
Submittal Review and Coordination Workshop No. 1	0.1%	35	$500/day
Design Deliverable No. 2	0.4%	60	$500/day
Submittal Review and Coordination Workshop No. 2	0.1%	65	$500/day
Design Deliverable No. 3	0.4%	30 days from receipt of Engineer's comments on Submittal No. 2	$500/day

Milestones Following Contract Assignment			
Milestone Completion	**Percent of Supplier's Lump Sum Proposal Amount to be Paid by Buyer**	**Milestone Completion Deadline (days past Assignment of Contract)**	**Amount of Liquidated Damages Assessable by Buyer**
Delivery of Membrane Equipment System	35%	365	$2,000/day
Completed Installation of Membrane Equipment System	35%	545	$2,000/day
Successful Completion of Performance Testing	18%	725	$2,000/day
Final Completion (Following release of retainage by Owner)	10.5%	905	$2,000/day

5. Note: The Buyer will retain 10 percent from each payment as retainage. Owner will release total retainage upon application for final payment by the Contractor after final inspection and acceptance of the Work included in the Contract Documents.
6. For delays with respect to schedule, Owner will consider request for escalation of Contract Price from the Seller as long as the escalation does not exceed CPI provided that the delays are not attributable to Seller's performance or failure to perform.

B. Liquidated Damages: Buyer and Seller recognize that time is of the essence of this Agreement, and the Owner will suffer financial loss if the Work is not completed within the times specified in the Payment Schedule, above, plus any extensions thereof allowed in accordance with the General Conditions. Owner and Seller further recognize the delays, expense and difficulties involved in providing in a legal or other dispute resolution proceedings, the actual loss suffered by the Owner if the Work is not completed on time. Accordingly, instead of requiring proof, Owner and Seller agree that as liquidated damages for delay (but not as a penalty), Seller shall pay Owner the amounts listed in the Payment Schedule, above, for each day that expires after the time specified.

1. In the event this is not paid, Seller agrees City may deduct that amount from any money due or that may become due under the Contract. This Article does not exclude recovery of other damages specified in the Contract Documents.

C. Release of Liability: Acceptance by the Contractor of the final payment shall be a release to the Owner and every officer and agent thereof from all claims and liability hereunder for anything furnished in connection with the Work, or for any act or neglect of the Owner or any person relating to or affecting the Work.

D. Payment for all the Work shown or specified in Contract Documents is included in the Contract Price. No measurement or payment will be made for individual items, unless otherwise specified hereinbefore in the Payment Application table.

E. Payment for Lump Sum Work covers all Work specified or shown within the limits or Specification sections.

1.05 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.

B. Use detailed Application for Payment Form suitable to Engineer.

C. Include accepted Schedule of Values for each schedule or portion of Work, the unit price breakdown for the Work to be paid on unit price basis, a listing of Owner-selected equipment, if applicable, and allowances, as appropriate.

D. Preparation:

1. Round values to nearest dollar.
2. List each Change Order executed prior to date of submission as separate line item. Totals to equal those shown on the Transmittal Summary Form for each schedule as applicable.
3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

E. The date for Seller’s submission of Application for Payment shall be established at the Preliminary Conference.

1.06 MEASUREMENT—GENERAL

A. All pay quantities of material are determined by the lump sum amounts proposed and the Payment Schedule table, specified herein before.

1.07 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.

1.08 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings or preliminary operation and maintenance manuals are acceptable to Engineer.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.09 PARTIAL PAYMENT FOR UNDELIVERED, PROJECT-SPECIFIC MANUFACTURED OR FABRICATED EQUIPMENT

A. Notwithstanding above provisions, partial payments for undelivered (not yet delivered to Site or not stored in the vicinity of Site) products specifically manufactured for this Project, excluding off the shelf or catalog items, will be made for products listed below when all following conditions exist:

1. Partial payment request is supported by written acknowledgment from Suppliers that invoice requirements have been met.
2. Equipment is adequately insured, maintained, stored, and protected by appropriate security measures.
3. Each equipment item is clearly marked and segregated from other items to permit inventory and accountability.
4. Authorization has been provided for access to storage Site for Engineer and Owner.
5. Equipment meets applicable Specifications of these Contract Documents.

B. Payment of 15 percent of manufacturer's quoted price for undelivered, Project-specific manufactured equipment will be made following Shop Drawing approval. Thereafter, monthly payments will be made based on progress of fabrication as determined by Engineer, but in no case will total of payments prior to delivery exceed 50 percent of manufacturer's quoted price.

C. Failure of Contractor to continue compliance with above requirements shall give cause for Owner to withhold payments made for such equipment from future partial payments.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 INTENT OF SECTION

A. This section describes administrative requirements of the Goods and Special Services, including schedules, engineering design support, shop drawings, operation and maintenance data, and other submittals.

B. The Seller shall adhere to all requirements of this section for the San Luis Obispo Water Resource Recovery Facility (WRRF) Membrane Equipment System Procurement. The Seller shall supply the design deliverables under the Professional Services Agreement and the rest of the specified products and services for the project under the General Contract after assignment to the General Contractor.

C. Wherever in this section an action is specified to be performed, such action shall be performed by, and shall be the responsibility of, the Seller unless specifically indicated otherwise.

1.02 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Seller that requires Engineer's approval.

B. Informational Submittal: Information submitted by Seller that does not require Engineer's approval.

C. Preliminary Operation and Maintenance (O&M) Data: Initial and subsequent submissions for Engineer's review.

D. Final O&M Data: Engineer-accepted data, submitted as specified herein.

E. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of Goods. Examples of typical maintenance operations are cleaning, lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03 PROJECT COORDINATION

A. Onsite Coordination:

1. The Seller will be required to coordinate with the Contractor for the Project.
2. Contractor will coordinate the activities at the Point of Destination related to the Goods furnished under this Contract.
3. Fully coordinate activities with Contractor and other contractors. Promptly bring to Buyer's attention any conflict or coordination problem.

1.04 CONTRACT PROGRESS REPORTING

A. Progress Schedule:

1. Bar Chart Schedule demonstrating Seller's plan for fulfilling Contract requirements.
2. Information shall be comprehensive and shall represent all activities, including submittals and procurement necessary to complete Contract.
3. Typical minimum detail on the schedule shall include, but not be limited to, the following:
    a. Delivery date(s) of Shop Drawings and Sample submittals.
    b. Delivery date(s) of Operation and Maintenance Data.
    c. Date Seller places purchase orders with major subcontractors and suppliers.
    d. Date of starting assembly of specified Goods.
    e. Date of finishing assembly of specified Goods.
    f. Date of testing at plant.
    g. Date of shipment from Seller.
    h. Date of arrival at Point of Destination.
4. Assist Buyer in determining the most current schedule information on the Contract items, including whether Seller is on schedule or delayed. These requirements apply fully to telephone inquiries, personal visits, letters, or other communication.
5. Schedule Reporting: Submit Notice of Schedule Impact at any time that a Progress Schedule activity is delayed by 5 or more days.
    a. Complete and submit to party named on the form attached.
    b. Transmit completed form either in facsimile, e-mail, or mail via registered overnight mail service.

1.05 INFORMATION REQUIRED WITH PROPOSAL DOCUMENT

A. Complete all Section 00 41 63, Proposal Form, Schedules and Supplements as required in Section 00 21 14, Instructions to Proposers, and Section 00 41 63, Proposal Form.

B. Information provided with the Proposal Documents shall be for the purpose of determining the responsiveness of the Proposal, and shall be used by the Buyer in selecting the successful Seller. This information in the proposal document shall be used by the Buyer for designing the WRRF upgrades. Use the key words at the beginning of each item below for tab labels in the submittal.

1. Exceptions: Identify any exceptions to this Specification. Some exceptions may be considered nonresponsive.
2. Recommendations: Provide any recommendations to make the Membrane Equipment System (MES) more cost effective while meeting all performance requirements stated herein. For each recommendation, identify any trade-offs in terms of operational flexibility, system performance, system footprint, or operations and maintenance (O&M) requirements. Provide any recommendations to modify the MES to more effectively and efficiently treat the water.
3. Missing Items: Identify any components that are not specified, but are necessary to provide a fully operational MES.
4. Patents: List of all patents held or pending on equipment proposed for this Project.

1.06 DESIGN DELIVERABLES REQUIRED DURING DESIGN

A. The Seller shall provide design information and participate in design workshops in accordance with the Seller's Services specified in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), and Section 01 43 34, Special Services. Each Design Deliverable shall incorporate review comments made by the Engineer on all previous deliverables.

B. The Seller shall provide the following technical data as part of Design Deliverable No. 1, to the Buyer within 30 days after Contract execution in accordance with the procedures indicated herein.

1. Itemized listing of all revisions or updates to the information provided in the proposal and reason for the change.
2. Structural design calculations of each component of the Membrane Equipment System stamped and signed by a Civil or Structural Engineer registered in the State of California. Design calculations shall conform to the requirement of the 2016 California Building Code, Part 2 of

Title 24. Calculations shall include seismic, wind, gravity, hydrostatic, hydrodynamic, and operational loading.

3. Anchorage design information including equipment weight, center of gravity, anchor bolt layout, anchor bolt diameter, anchor bolt forces, and other pertinent information required to design the anchorage of the equipment.
4. For software, provide narrative description of control system, logic diagrams, summary of control functions, summary of monitoring functions, description of alarms, and other information to describe the control system.
5. Listing of complete scope of supply of equipment, valves, instruments, components, and materials included with the Proposal. Provide the following for pumps, valves, and all other mechanical equipment provided by Seller, including but not limited to, compressors, air separators, etc.:
    a. Motor submittal information as required per Section 26 05 01, Electrical.
    b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction. Seal, coupling, and bearing literature shall be included with the pump information.
    c. Detailed Mechanical Drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
6. Submit overall process flow diagram, calculations, and design data to substantiate selection of equipment and pipe sizing. Provide design flow rates for all systems and subsystems.
7. Scaled equipment and piping layout drawings in both plan and section. The Drawings shall show the size, type and locations (with dimensions) of all mechanical and electrical equipment, piping valves, instruments, components and appurtenances within membrane tanks and trains. Identify all external interface connections. Provide clear delineation between equipment, valves, and piping supplied by the Supplier, and equipment, valves, and piping supplied by others.
8. Scaled drawings in sufficient detail for the Engineer's use in designing reinforced concrete tanks, channels, building structures and associated tank cover openings, and lifting devices required for maintenance of the system. Show all system required concrete embeds, and identify the size and location of field piping connections to be provided by others. Drawings shall be accompanied by information on structural loadings and forces according to the California seismic design regulations as indicated elsewhere in this document in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), to be used by the Engineer for design of the reinforced concrete structures, lifting devices, and other appurtenances. Provide clear delineation between piping,

equipment, and materials supplied by the Seller and piping, equipment, and materials supplied by others.

9. Plan, section and detail drawings in electronic form, using the latest version of MicroStation.
10. Provide detailed mixed liquor distribution requirements into the membrane trains, including any special connections and required pressure if distribution headers are used.
11. Provide the flow rate and dynamic head loss for recirculation flow through membrane equipment as applicable.
12. Provide air scour requirements in terms of pressure and air flow for various membrane trains in service based on membranes supplied and for various membrane trains in service based on all empty spaces filled with membranes. Provide minimum pressure required at connection to air scour header taking into account submergence, header, and diffuser losses.
13. Provide air extraction system pressure and flow requirements at connection to the air separation column of permeate pumps as applicable.
14. Provide instrument air demands (total flow and pressure) and air quality requirements.
15. Provide the following Electrical Drawings and Information:
    a. List of special motor features being furnished (i.e., space heaters, thermal protectors, etc.).
    b. Complete motor rating for all 480V, three-phase motors including motor no-load, starting, and full-load current at rated voltage; full-load speed and full-load current at 100 percent voltage; motor efficiency and power factor at 50 percent, 75 percent, and full load (100 percent) at rated voltage.
    c. List any components that will run off power supply other than 480V, three-phase. (Note: Such power should be supplied to a single point to be identified by the Seller and then distributed to individual components.)
    d. One-line diagram(s) including all transformers, drives, panel boards, meters, and protective devices.
16. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
17. Provide the following Instrumentation and Control Drawings and Information:
    a. Process and Instrumentation Diagrams (P&IDs) for the system, as per the requirements specified in Section 40 99 90, Package Control Systems. Provide clear delineation between equipment, piping, and components supplied by the Seller, and equipment, piping and components supplied by others.
    b. Provide examples of HMI screens that have been provided on previous projects.

c. Provide a block diagram of the proposed control system including the HMI(s), PLC(s), and the data highway.
d. Provide listing of all alarm events and all other events that could cause a membrane train to shut down or to be placed into standby or shutdown or any other nonproducing state.

18. The Seller shall provide details of the following process areas and equipment on the P&ID drawings as a minimum:
    a. Membrane equipment system.
    b. Membrane tanks.
    c. Mixed liquor feed system (if applicable).
    d. Membrane permeate pumping system and piping.
    e. Membrane air scour blower system and piping.
    f. Back pulse pumping system, tanks and piping.
    g. Membrane tank drain system.
    h. Membrane chemical cleaning dosing systems.
    i. Compressed air system (if applicable).
    j. P&ID Legend Sheets, as per sample drawings provided.
    k. Neutralization system.
    l. Any other system, which is directly interfaced with the membrane system.
19. P&ID shall also indicate PLC panel tags to which each component is wired to.
    a. Process Control Narratives which define process control concepts and compliment the P&IDs. Describe functions monitored, controlled and alarmed.
    b. For applications software, provide narrative description of process control systems and overall control system, logic diagrams, summary of control functions, summary of monitoring functions, description of alarms, and other information to describe the control system.
20. Provide a detailed instrument list for all field instruments including service, type of instrument, make/model number, range, hazardous area classification, and mounting details.

C. Design Deliverable No. 2:

1. The Seller shall submit the following technical data as part of Design Deliverable No. 2 to the Buyer within 60 days after Contract execution, in accordance with the procedures indicated herein:
    a. Itemized listing of all revisions or updates to previous design deliverables and reason for the change.
    b. Final version (all comments incorporated) of all information provided in Design Deliverable No. 1.
    c. Comprehensive information of the Seller's updated scope of supply and installation information necessary for inclusion into the Construction Contract Documents.

D. Design Deliverable No. 3:

1. The Seller shall submit the following technical data as part of Design Deliverable No. 3 to the City within 30 days upon notice to proceed with this deliverable. Design Deliverable No. 3 will be required prior to the Bid Advertisement for the San Luis Obispo WRRF upgrade project. Design Deliverable No. 3 shall be in accordance with the procedures indicated herein:
    a. Itemized listing of all revisions or updates to previous design deliverables and reason(s) for the change.
    b. Design Deliverable No. 3 shall include any design changes based on proven advancements to the Membrane Equipment System products (at the time of submission). The necessary changes shall be clearly indicated and made to the information provided in Design Deliverable No. 2.
    c. Comprehensive information of the Supplier's updated scope of supply and installation information necessary for inclusion into the Construction Contract Documents.
    d. Review of Construction Contract Documents: Seller shall review the Engineer's Contract Documents and Specifications for construction of the WRRF Membrane Equipment System facilities within 14 calendar days of receipt of the review submittal and prior to proposing the WRRF project construction contract. Seller shall submit review comments and certification to the Engineer that the WRRF design drawings and specifications are consistent with the Seller's scope of work and are appropriate for proposing and construction of facilities related to the installation, startup, and testing of the Seller's Membrane Equipment System.

1.07 SUBMITTALS REQUIRED DURING CONSTRUCTION/AFTER SCOPE OF SUPPLY IS ASSIGNED TO CONTRACTOR (REQUIRED AFTER THE CONTRACT ISSUANCE BY THE CONTRACTOR)

A. The following Shop Drawings:

1. Itemized listing of all revisions or updates to previous design Deliverable No. 3 and reason for the change.
2. Final arrangement drawings and specifications of all items and equipment showing all dimensions required for installation, weights, forces, pipe supports and locations, and construction details and materials required to demonstrate compliance with these Specifications.
3. Provide the following for pumps, valves, and all other mechanical equipment provided by the Seller including, but not limited to, compressors, air separators, etc.:
    a. Anchor bolt sizing and configuration (Note: Anchor bolts shall be provided by others based on Seller's sizing recommendations).

b. Power and control wiring diagrams, including terminals and numbers.

4. For Piping Systems, provide:
   a. Detailed pipe fabrication and spool drawings showing special couplings, fittings and bends, dimensions, coatings, and other pertinent information. Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.
   b. Pipe wall thickness and rational method or standard applied to determine wall thickness for each size of each different service.
   c. Details of hydraulic thrust restraint.
   d. Sizing calculations for open-close/throttle and modulating valves.
   e. Certified welding inspection and test results.
   f. Qualifications of welders and weld inspectors.
   g. Qualified welding procedures.
   h. Nondestructive inspection and testing procedures.
5. For all connections between equipment provided by the Seller and equipment or works provided by others, provide:
   a. Layout and details of complete attachment assemblies including connection hardware, braces, and anchor bolts. Anchor bolts will be provided by others.
   b. Recommended size and location of anchor bolts, supplied by others, based on 4,000 psi concrete.
6. Indicate the paint and coating system for each equipment item. Provide data sheets for each paint system with PSDS, manufacturer's technical data.
7. Provide the following Electrical Drawings and Information:
   a. Motor data as required by Section 26 05 01, Electrical.
   b. Panel elementary diagrams of prewired panels including control devices and auxiliary devices.
   c. Wiring and control diagrams of membrane systems and equipment, including all motors and local control panels.
   d. Complete catalog information, descriptive literature, specifications, and identification of materials of construction including boxes, device plates, junction and pull boxes, wiring devices, circuit breakers and switches, motor-rated switches, control devices, terminal block, and relays, contactors, transformers, support and framing channels, nameplates and nameplate schedule, conduit, fittings, and accessories, wireways, conductors, cable, and accessories, and grounding materials. Submit these items per the requirements of Section 26 05 01, Electrical.

8. Provide the following Instrumentation and Control Drawings and Information:
    a. Final P&IDs consistent with legend requirements.
    b. Detailed PLC system block diagram including network communications architecture, control panel layouts, Control panel power distribution diagram, loop diagrams, Instrument installation details, configuration data, I/O lists and I/O point addresses. Include a detailed bill of materials for all PLC hardware. Provide this information in an electronic format (CD-ROM) along with hard copies. Where sample drawings are included in the Request for Proposal documents, submitted drawings shall have the same format.
9. Include complete I/O lists with addresses and field terminal numbers.
10. Instrumentation and control description detailing treatment system startup, shutdown procedures, operation, control, and monitoring, including interface requirements as specified herein.
11. Submit manufacturer's printed installation instructions and information including mounting requirements, access, approximate weight of each major piece of equipment, and required conduit size and routing.
12. Estimated delivery time for various materials and equipment items.

B. The following Informational Submittals:

1. Provide required membrane system handling procedures including, but not limited to, protection of equipment prior to and during installation, removal of membrane preservatives, and extended out-of-service storage and handling.
2. Manufacturer's Certificates of Proper Installation.
3. Test plans per Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).
4. Factory test reports and field test reports for all process equipment for which testing is required.
5. Test logs for piping systems.
6. Field test reports for electrical equipment.
7. Data summary for testing and startup.
8. Preliminary and final Operations and Maintenance Manuals for all equipment provided per Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), Section 43 12 01, Compressed Air Systems, Section 44 42 19.04, Rotary Positive Displacement Blower, and Section 44 42 56.10, Horizontal End Suction Centrifugal Pumps.
9. For the O&M manual for the Membrane System Equipment submit a document (up to five pages) summarizing all the requirements that must be followed to maintain the full warranty of the membranes and the system.
10. Executed warranties.

C. Applications Software Documentation:

1. General: Seller shall provide applications software for all PLC components provided as part of the system. Seller shall provide applications software for three operator interfaces.
2. Delivery:
    a. Provide a preliminary version of application software including programmer's comments at completion of Factory Witness Testing, before shipment of control equipment.
    b. Provide final version at completion of performance acceptance testing, after final changes to application software are completed.
3. Complete configuration documentation for microprocessor-based configurable devices.
4. For each device, include a program configuration listing showing:
    a. Function blocks or modules used.
    b. Configuration, calibration, and tuning parameters.
    c. Descriptive annotations.
5. Programmable Controller Submittals:
    a. Complete set of user manuals.
    b. PLC program description.
    c. Fully documented application program files, associating internal device addressing with program tags and symbols.
    d. Function listing for function blocks not fully documented by application program listings.
    e. Cross-reference listing and interface register assignments.
    f. PLC input/output listings.
    g. Downloadable PLC application software program, identical to program installed in the device at time of delivery.
        1) Compiled and pre-compiled (source code) versions in native format downloadable to the device.
        2) Include documentation internal to the program in the compiled and pre-compiled (source code) versions.
    h. Format:
        1) Electronic files of PLC submittals on PC-compatible CD-ROM disk.
        2) Hard copy version in three-ring binders. Provide three copies.
6. Communication Computer Submittals:
    a. Complete set of user manuals for hardware, standard software, and applications software.
    b. System installation and software setup details, including all parameters settings and attribute assignments.
    c. Copies of all operator interface screens.
    d. Database listings showing all configuration information, including I/O addressing.

e. With Final Version of Submittal Package (Only): Standard software authorization codes. (Microsoft Windows certificates of authenticity.)

1.08 PROCEDURES FOR DESIGN INFORMATION DELIVERABLE REQUIRED DURING DESIGN/AFTER CONTRACT AWARDED TO SELLER

A. Direct submittals required during Design to Engineer at the following address unless specified otherwise:

1. CH2M HILL, 1100 N.E. Circle Blvd., Suite 300, Corvallis, OR 97330.
2. No. of Copies: Five bound hard copies and five electronic disk copies in PDF format. Drawings shall be in MicroStation V8i or AutoCAD 2015 format.

1.09 PROCEDURES FOR SUBMITTALS REQUIRED DURING CONSTRUCTION/ AFTER CONTRACT ASSIGNED TO CONSTRUCTION CONTRACTOR

A. Direct submittals to Contractor, unless otherwise directed.

B. Electronic Submittals: Submittals shall, unless specifically accepted, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal book marking from an index page to major sections of the document.
3. PDF files shall be set to open “Bookmarks and Page” view.
4. PDF files shall be set to “Fit Page” magnification.
5. PDF files shall be set to “Single” page layout.
6. PDF files shall be word searchable.
7. Add general information to each PDF file, including title, subject, author, and keywords.
8. PDF files shall be set up to print legibly at 8.5-inch by 11-inch in Portrait orientation, or 11-inch by 17-inch in Landscape orientation. No other paper sizes will be accepted.
9. Submit new electronic files for each resubmittal.
10. Include a copy of the Transmittal of Contractor’s Submittal form, located at end of section, with each electronic file.
11. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
12. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

C. Transmittal of Submittal:

1. Review each submittal and check for compliance with Contract Documents.
2. Stamp each submittal with uniform approval stamp before submitting; stamp to include Project name, submittal number, Specification number, Seller's reviewer name, date of Seller's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents. Engineer will not review submittals that do not bear Seller's certification as required by the General Conditions, and will return them without action.
3. Complete, sign, and transmit with each submittal package, one Transmittal of Seller's Submittal form attached at end of this section.
4. Identify each submittal with the following:
    a. Numbering and Tracking System:
        1) Sequentially number each submittal.
        2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
    b. Specification section and paragraph to which submittal applies.
    c. Project title and Engineer's project number.
    d. Date of transmittal.
    e. Names of Seller, Subcontractor or Supplier, and manufacturer as appropriate.
5. Identify and describe each deviation or variation from Contract Documents.

D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
3. Index with labeled tab dividers in orderly manner.

E. Timeliness of Submittal: Schedule and submit in accordance with the Seller's Progress Schedule, and requirements of individual Specification sections.

F. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Seller's submittal and transmit response to Seller not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed due to delays in providing Goods or Special Services caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Engineer will return entire submittal for Seller's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
    a. Seller's certification as required by the General Conditions.
    b. Transmittal of Seller's Submittal, completed and signed.
    c. Insufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return all remaining copies to Seller.

J. Action Submittals:

1. Prepare and submit as required by individual Specification sections and this Specification section.
2. Shop Drawings:
    a. Copies: Five.
    b. Identify and Indicate:
        1) Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
        2) Goods and Component Title: Identical to title shown on Drawings.
        3) Critical field dimensions and relationships to other critical features. Note dimensions established by field measurement.
        4) Project-specific information drawn accurately to scale.
    c. Manufacturer's standard schematic drawings and diagrams as follows:
        1) Modify to delete information that is not applicable.
        2) Supplement standard information to provide information specifically applicable.
    d. Product Data: Provide as specified in individual Specifications.
    e. Foreign Manufacturers: When proposed, include following additional information:
        1) Names and addresses of at least two companies that maintain technical service representatives close to Project.
        2) Complete list of spare parts and accessories for each piece of equipment.

K. Action Submittal Dispositions:

1. Engineer will review, mark, and stamp as appropriate, and distribute marked-up copies as noted:
   a. Approved:
      1) Seller may provide Goods or Special Services covered by submittal.
      2) Distribution: Electronic.
   b. Approved as Noted:
      1) Seller may provide Goods or Special Services covered by submittal, in accordance with Engineer's notations.
      2) Distribution: Electronic.
   c. Partial Approval, Resubmit as Noted:
      1) Make corrections or obtain missing portions, and resubmit.
      2) Except for portions indicated, Seller may begin to provide Goods or Special Services covered by submittal, in accordance with Engineer's notations.
      3) Distribution: Electronic.
   d. Revise and Resubmit:
      1) Seller may not provide Goods or Special Services covered by submittal.
      2) Distribution: Electronic.

L. Informational Submittals:

1. Copies: Electronic.
2. Refer to individual Specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward submittal to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will return with review comments to Seller, and require that submittal be corrected and resubmitted.

1.10 OPERATION AND MAINTENANCE (O&M) DATA

A. Format and Scheduling:

1. Preliminary Data:
   a. Format: Instructional Manual.
   b. Submit subsequent to Engineer approval of Shop Drawings, but prior to shipment date.

c. Submit electronic copies for Engineer's review.
1) If data does not meet conditions of the Contract:
a) Resubmit, revised in accordance with Engineer's comments.

2. Final Data:
a. Submit at the time of shipment of Goods.
b. Format: Instructional Manual. Electronic Media.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
a. Project title.
b. Designate applicable system, equipment, material, or finish.
c. Identity of separate structure as applicable.
d. Identity of general subject matter covered in manual. Identity of equipment number, if applicable, and Specification section.
4. Title Page:
a. Seller's name, address, and telephone number.
b. Subcontractor, supplier, or maintenance contractor's name, address, and telephone number, as appropriate.
1) Identify area of responsibility of each.
2) Provide name and telephone number of local source of supply for parts and replacement.
5. Table of Contents:
a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
6. Paper: 20-pound minimum, white for typed pages.
7. Text: Manufacturer's printed data, or neatly typewritten.
8. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.

b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

D. Data Content:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
   c. Function, normal operating characteristics, and limiting conditions.
   d. Performance curves, engineering data, nameplate data, and tests.
   e. Complete nomenclature and commercial number of replaceable parts.
   f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
   g. Spare parts ordering instructions including contact information.
   h. Where applicable, identify installed spares and other provisions for future work (for example, reserved panel space, unused components, wiring, terminals).
2. Color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings:
   a. Supplement product data with Drawings as necessary to clearly illustrate:
      1) Format:
         a) Provide reinforced, punched, binder tab; bind in with text.
         b) 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
         c) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
         d) Identify Specification section and product on Drawings and envelopes.
      2) Relations of component parts of equipment and systems.
      3) Control and flow diagrams.
      4) Coordinate drawings with Project record documents to assure correct illustration of completed installation.

5. Instructions and Procedures: Within text, as required to supplement product data.
    a. Format:
        1) Organize in consistent format under separate heading for each different procedure.
        2) Provide logical sequence of instructions for each procedure.
        3) Provide information sheet for Buyer's personnel, including:
            a) Proper procedures in event of failure.
            b) Instances that might affect validity of guarantee or Bond.
    b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
    c. Operating Procedures:
        1) Startup, break-in, routine, and normal operating instructions.
        2) Test procedures and results of factory tests where required.
        3) Regulation, control, stopping, and emergency instructions.
        4) Description of operation sequence by control manufacturer.
        5) Shutdown instructions for both short and extended duration.
        6) Summer and winter operating instructions, as applicable.
        7) Safety precautions.
        8) Special operating instructions.
    d. Maintenance and Overhaul Procedures:
        1) Routine maintenance.
        2) Guide to troubleshooting.
        3) Disassembly, removal, repair, reinstallation, and re-assembly.

E. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data, nameplate data, and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
    d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards:
    a. Electrical service.
    b. Controls.
    c. Communications.
3. List of electrical relay settings and control and alarm contact settings.
4. Electrical interconnection wiring diagram, including control and lighting systems.

5. Operating Procedures:
    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Safety precautions.
    d. Special operating instructions.
6. Maintenance Procedures:
    a. Routine maintenance.
    b. Guide to troubleshooting.
    c. Adjustment and checking.
    d. List of relay settings, control and alarm contact settings.
7. Manufacturer's printed operating and maintenance instructions.
8. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

F. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable item, respective unit or system, and for components or sub-units.
2. Format:
    a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
    b. Each Maintenance Summary may take as many pages as required.
    c. Use only 8-1/2-inch by 11-inch size paper.
    d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
    a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
    b. "Unit" is the unit of measure for ordering the part.
    c. "Quantity" is the number of units recommended.
    d. "Unit Cost" is the current purchase price.

1.11 SUPPLEMENTS

A. The Supplements listed below, following "End of Section," are part of this Specification:

1. Notice of Schedule Impact.
2. Transmittal of Seller's Submittal.
3. Maintenance Summary Form.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

NOTICE OF SCHEDULE IMPACT

(Send this form as addressed if delay is over 5 days. Send either via fax, e-mail, or registered, overnight mail.)

To: **(Name of Engineer or Buyer's Firm or Construction Contractor)**

Attention: **(Name of Recipient)**

Address: **(Recipient's)**

Fax No.: **(Recipient's)**

E-mail: _____

RE: Contract No.: _____

Name of Contract: _____

Type of Goods: _____

Nature of Delay: _____

New Estimated Date for Final Shop Drawings: _____

New Estimated Date for Start of Manufacture: _____

New Estimated Date for Finish of Manufacture: _____

New Estimated Date for Shipment: _____

New Estimated Date for Arrival at Point of Destination: _____

SELLER:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Telephone: _____

E-mail: _____

By (Name/Title): _____ Date: _____

TRANSMITTAL OF SELLER'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

Date: _____

TO: _____

_____

_____

_____

_____

Submittal No.: _____

☐ New Submittal ☐ Resubmittal

Project: _____

Project No.: _____

Specification Section No.: _____

(Cover only one section with each transmittal)

Schedule Date of Submittal:

_____

FROM: _____

Seller

_____

_____

_____

SUBMITTAL TYPE: ☐ Shop Drawing ☐ Sample ☐ Informational

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

SELLER hereby certifies that (i) SELLER has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____

SELLER (Authorized Signature)

MAINTENANCE SUMMARY FORM

PROJECT:_____ CONTRACT NO.:_____

1. ITEM_____

2. MANUFACTURER _____

3. TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. SELLER'S LOCAL REPRESENTATIVE _____

   a. Name_____ Telephone No. _____

   b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

8. LUBRICANT LIST

Reference Symbol	Shell	Standard Oil	Gulf	Arco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR BUYER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).

1.02 QUALITY CONTROL

A. Source Quality Control: Where specified for Goods, factory test results shall be reviewed and accepted by the Engineer before such Goods are shipped.

B. Field Quality Control: Conduct functional and performance testing and completion of Manufacturer's Certificate of Proper Installation, as required in Section 01 43 34, Special Services.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 34
SPECIAL SERVICES

PART 1 GENERAL

1.01 INTENT OF SECTION

A. This section describes Special Services, including design, supervision and inspection of installation, certification of proper installation, and commissioning.

B. The Seller shall adhere to all requirements of this section for the San Luis Obispo Water Resource Recovery Facility, Membrane Equipment System. The Seller shall supply all specified products and services to the project, described in this Section.

C. Wherever in this section an action is specified to be performed, such action shall be performed by, and shall be the responsibility of, the Seller unless specifically indicated otherwise.

1.02 DEFINITIONS

A. Functional Testing: Tests necessary to demonstrate that installed Goods function as specified and operate in the manner intended. Functional testing is a prerequisite to performance testing for Goods specified to have a performance test.

B. Performance Testing: Tests necessary to demonstrate, after successful functional testing, that Goods meet specified performance requirements.

C. Installing Contractor: The entity, under separate contract with the Buyer, whose responsibilities include the installation of the Goods provided under this Contract.

D. Commissioning: Procedure to bring process into working condition ensuring facility, systems, subsystems, and equipment are installed correctly and fully functional.

E. Person Day: One person for 8 hours during normal working hours.

1.03 SUMMARY OF SPECIAL SERVICES

A. The following Special Services shall be furnished by the Seller during the design period and shall be included as a lump sum Proposal Price:

1. Special Engineering Services Prior to Assignment of the Seller's Contract to the Contractor.
    a. Design Assistance to the Engineer.
    b. Furnish required design information deliverables and participate in workshops.
    c. Coordination and Data Integration with Plant Control System.
    d. Review of Construction Drawings prepared by Engineer.

B. The following Special Services shall be furnished by the Seller in addition to requirements listed in Section 01 30 00, Administrative Requirements, under this Contract and shall be included in the Contract Price and Contract that will be assigned to the Contractor:

1. Special Services During Construction/After Contract Assigned:
    a. Factory inspection and testing.
    b. Delivery of Equipment.
    c. Installation Assistance to Contractor.
    d. Inspection.
    e. Coordinate with Plant Control System supplier for interface requirements between the Membrane Equipment System Control System and the Plant Control System software development.
    f. Certificate of Proper Installation.
    g. PLC Software, Startup, and Testing for Control Software for Membrane Equipment System as described in Section 40 99 90, Package Control Systems, and Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).
2. Coordination and Service during Startup and Commissioning:
    a. Functional Testing.
    b. Performance Testing.
    c. Startup Assistance to Contractor.
    d. Prestartup and Post-startup Training.
    e. Commissioning Services.
    f. Post Commissioning Services.

1.04 MANUFACTURER'S REPRESENTATIVE

A. Where Special Services are specified, Seller shall furnish a qualified, factory trained representative of manufacturer for the number of person days and separate trips indicated. Include these services, as described above, in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), and in Section 01 30 00, Administrative Requirements.

B. If manufacturer's representative is found deficient in training or experience by Buyer or Engineer, promptly furnish replacement representative after acceptance of resume and other qualification documentation of proposed representative.

1.05 SUPERVISION AND INSPECTION OF INSTALLATION

A. Supervise and inspect installation of Goods by Contractor to ensure that Goods are installed in accordance with the manufacturer's instructions.

1.06 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. A Manufacturer's Certificate of Proper Installation Form, a copy of which is attached to this section, shall be completed and signed by Seller's representative.

B. Such form shall certify signing party is a duly authorized representative of Seller, is empowered by Seller to inspect, approve, and operate their Goods and is authorized to make recommendations required to ensure that the Goods are complete and operational.

1.07 COMMISSIONING ASSISTANCE

A. Functional Testing: Assist installing contractor in performing functional (or run) testing of furnished Goods. Furnish representative to assist with test and necessary adjustments.

B. Performance Testing:

1. Assist installing contractor in conducting performance testing of furnished Goods. Furnish representative to assist with tests as specified for the particular Goods and to correct malfunctions.
2. Where certain Goods must be performance tested and accepted after successful startup of a system or an entire facility, such testing shall not be performed until system or facility has been accepted.

C. Startup Assistance:

1. Furnish representative to assist installing contractor with startup of furnished Goods:
   a. Seller's representative shall be present during prestartup meetings.
   b. Furnish labor and materials, tools, instruments, and services for checking, testing, and startup specified.
   c. Develop a standard record of testing. This record shall:
      1) Be subject to approval of Engineer.
      2) Include name of Goods and subsystem, if applicable.

3) Have provisions for recording dates of completion for checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests.
4) Allow space for describing problems remaining with Goods, and for signature of Engineer indicating acceptance.

1.08 DEMONSTRATION AND TRAINING

A. Furnish Seller's representative to instruct Buyer's personnel in proper operation and maintenance techniques for the furnished Goods:

B. Training services may include classroom or onsite instruction, either prestartup or post-startup, as stated in the Specifications.

C. Submit a Training Program outline to the Buyer for approval prior to any training. The Training Program shall include the following information and instruction as a minimum:

1. Purpose of the equipment.
2. Principles of the equipment or system.
3. Operation of and need for each piece of equipment in the system.
4. Equipment monitoring and controls.
5. Startup and shutdown of the equipment.
6. Emergency operation procedures.
7. Equipment routine maintenance and preventative maintenance.
8. Operational troubleshooting.

D. Prestartup Training:

1. Prestartup training shall be completed at least 14 days prior to actual startup.
2. Operation and Maintenance Data shall be reviewed and accepted, before initiation of prestartup training.

E. Post-Startup Training: Furnish and coordinate specified manufacturers' services and Seller's personnel for post-startup training of Buyer's operating personnel.

F. Recording of Training Sessions:

1. Furnish audio and color recording of prestartup and post-startup training sessions, including manufacturer's representatives' hands-on equipment instruction and classroom sessions.
2. Use DVD format suitable for playback on standard equipment available commercially in the United States.

3. Include one training session on each DVD.
4. Furnish Buyer with two complete sets of recordings fully indexed and cataloged with printed label stating session and date recorded.
5. If quality of recording is found deficient by Buyer or Engineer, Seller is responsible for repeating the training or providing an alternative recording acceptable to Buyer and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this Specification:

1. Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

BUYER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- ☐ Installed in accordance with manufacturer's recommendations.
- ☐ Inspected, checked, and adjusted.
- ☐ Serviced with proper initial lubricants.
- ☐ Electrical and mechanical connections meet quality and safety standards.
- ☐ All applicable safety equipment has been properly installed.
- ☐ Functional tests.
- ☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate its equipment and (iii) authorized to make recommendations required to ensure that the Goods furnished by the Seller are complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Seller: _____

Manufacturer's Authorized Representative: _____
(Authorized Signature)

SECTION 01 61 01
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 INTENT OF SECTION

A. This section describes general product requirements of the Work including preparation for shipment, delivery, and unloading of the Goods.

B. The equipment Seller provides shall adhere to all requirements of this section for the San Luis Obispo Water Resource Recovery Facility, Membrane Equipment System. The Seller shall supply all specified products and services to the project under the Construction Contract.

C. Wherever in this section an action is specified to be performed, such action shall be performed by, and shall be the responsibility of, the Seller unless specifically indicated otherwise.

1.02 DESIGN REQUIREMENTS

A. As specified in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 130 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 20 degrees F to 115 degrees F.

C. Equipment and devices will be installed in an unclassified area.

1.04 PREPARATION FOR SHIPMENT

A. Where specified, factory test results shall be reviewed and accepted by Buyer or Engineer before Goods are shipped.

B. When practical, Goods shall be factory assembled. When impractical:

1. Furnish assembly instructions.
2. Mark or tag the separate parts and assemblies for field assembly.
3. Cover machined and unpainted parts that may be damaged by elements with a strippable protective coating.

C. Package or crate Goods to provide protection from damage during shipping, handling, and storage.

D. Marking: Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of project and Seller, equipment number, and approximate weight.

E. Spare Parts and Special Tools:

1. Deliver at same time as Goods delivery.
2. Mark to identify associated products by name, equipment, and part number.
3. Package parts for protection against damage from elements during shipping, handling, and storage.
4. Ship in boxes or containers marked to indicate contents and as stated above.

F. Accessories:

1. Deliver at same time as Goods delivery.
2. Furnish accessories required to place each item of equipment in full operation.
3. Accessories include, but are not limited to, adequate oil and grease as required for first lubrication of equipment (after field testing), light bulbs, fuses, hydrant wrenches, valve keys, chain operators, special tools, and other items as required for initial operation.
4. Furnish all lubricants required for storage, testing, and startup and for a 1 year period of operation beginning at substantial completion of the project. Furnish lubricants in original sealed containers correctly identified as to brand, grade, and intended use.

1.05 DELIVERY OF GOODS

A. Point of Destination: Water Resource Recovery Facility, 35 Prado Road, San Luis Obispo, CA 93401.

B. Notify Buyer, on Seller’s Notice of Shipment of Goods form attached to this Section, 15 days prior to shipment of Goods. Provide all applicable information requested on form.

C. Notify Contractor by telephone 24-hour prior to expected delivery time at the Point of Destination. Notice shall include approximate hour of delivery.

D. Delivery of Goods shall be made during regular daytime working hours, Monday through Friday, unless other arrangements have been made previously with the Contractor.

E. Plant staff are not authorized to receive Goods. Deliver all Goods, including spare parts, special tools, and accessories, to Contractor.

F. Inspection on Delivery:

1. Contractor will record receipt of Goods at the Point of Destination.
2. Upon receipt of Goods at the Point of Destination, Contractor will inspect for completeness and evidence of damage during shipment.
3. Seller shall be present for inspection.
4. Should there appear to be damage, Contractor shall immediately inform the transportation carrier, Seller, and Buyer.
5. Damaged or incomplete Goods to be returned to Seller for replacement will not be unloaded, except as necessary to expedite return shipment.
6. Seller shall expedite replacement of damaged, incomplete, or lost items.

1.06 UNLOADING OF GOODS

A. After acceptance by inspecting party, Goods will be unloaded by Contractor in accordance with manufacturer's instructions, or as specified.

1.07 SUPPLEMENT

A. The Supplement listed below, following "End of Section," is part of this Specification:

1. Seller's Notice of Shipment of Goods.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SELLER'S NOTICE OF SHIPMENT OF GOODS

Delivery of this notice should be either via fax, e-mail, or registered overnight mail.

To: _____

Attention: _____

Address: _____

_____

Fax No.: _____

E-mail: _____

RE: Contract No.: _____

Name of Contract: _____

Goods to be Shipped: _____

_____

ATTACH BILL(S) OF LADING FOR ALL SHIPMENTS TO THIS FORM.

Date of Shipment: _____

Manner of Shipment/Name of Carrier: _____

Anticipated Date of Delivery: _____

Special Equipment or Services Required for Unloading/Storage: _____

_____

_____

SELLER:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Telephone: _____

E-mail: _____

By (Name/Title): _____ Date: _____

SECTION 26 05 01
ELECTRICAL

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section covers electrical products including motors, conductors, circuit breakers and boxes, associated with the Membrane Equipment System.

B. The following products are not included in the Membrane Equipment System. For coordination requirements refer to Section 01 43 34, Special Services:

1. Motor Starters.
2. Motor Control Centers.
3. Variable Frequency Drives.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Bearing Manufacturers Association (ABMA):
   a. 9, Load Ratings and Fatigue Life for Ball Bearings.
   b. 11, Load Ratings and Fatigue Life for Roller Bearings.
2. Institute of Electrical and Electronics Engineers, Inc. (IEEEC):
   a. 112, Standard Test Procedures for Polyphase Induction Motors and Generators.
   b. 114, Standard Test Procedures for Single-Phase Induction Motors.
   c. 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Motors.
   d. 841, Standard for Petroleum and Chemical Industry – Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – up to and including 500 hp.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. MG 1, Motors and Generators.
   c. MG 13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. UL:
   a. 1, Flexible Metal Conduit.
   b. 2111, Overheating Protection for Motors.

1.03 DESIGN REQUIREMENTS

A. Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 480-volt, three-phase, grounded, 60-Hz. Some control equipment may operate at 120-volt, single-phase, grounded, 60-Hz or 24V dc.

1.04 DEFINITIONS

A. CISD-TEFC: Chemical industry, severe-duty enclosure for motors.

B. TEFC: Totally enclosed, fan cooled enclosure.

C. Motor Nameplate Horsepower: That rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

D. Inverter Duty Motor: Motor meeting all applicable requirements of NEMA MG 1, Section IV, Parts 30 and 31.

1.05 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for additional information regarding submittals.

B. Action Submittals:

1. Electrical schematic (elementary) motor control diagrams showing circuits and devices in ladder-diagram form.
2. Connection (wiring) diagrams showing connections and physical locations of electrical circuits and devices.
3. Motors:
    a. Descriptive information.
    b. Nameplate data in accordance with NEMA MG 1.
    c. Additional Rating Information:
        1) Service factor.
        2) Locked rotor current.
        3) No load current.
    d. Enclosure type and mounting (e.g., horizontal, vertical).
    e. Dimensions and total weight.
    f. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70.
    g. Bearing type.
    h. Bearing lubrication.
    i. Bearing life.
    j. Space heater voltage and watts.
    k. Description, ratings, and wiring diagram of motor thermal protection.

l. Motor sound power level in accordance with NEMA MG 1.
m. Maximum brake horsepower required by the equipment driven by the motor.

C. Informational Submittals:

1. Factory test reports.
2. Operation and Maintenance Data: As specified in Section 01 30 00, Administrative Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Motors:

1. General Electric.
2. Siemens Energy and Automation, Inc., Motors and Drives Division.
3. Baldor.
4. U.S Electrical Motors.
5. TECO-Westinghouse Motor Co.
6. Toshiba International Corp., Industrial Division.
7. WEG Electric Motors Corp.

B. Boxes:

1. Hoffman.
2. Appleton.
3. Crouse Hinds.

C. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Carlon; Carflex or X-Flex.
2. T & B; Xtraflex LTC or EFC.

D. Conductors:

1. Belden.
2. Okonite.
3. Southwire.

E. Circuit Breakers:

1. Eaton/Cutler-Hammer.
2. General Electric.
3. Siemens.

F. Plug-in Relays:

1. IDEC.
2. Square D.
3. “Or-equal.”

G. Elapsed Time Meters (ETM):

1. Crompton.
2. Yokogawa.
3. “Or-equal.”

2.02 GENERAL

A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

B. In order to obtain single source responsibility, utilize a single supplier to provide a drive motor, its driven equipment, and specified motor accessories.

C. Motors shall meet requirements of NEMA MG 1.

D. Frame assignments in accordance with NEMA MG 13.

E. Motors shall be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.

F. Lifting lugs on all motors weighing 100 pounds or more.

G. Operating Conditions:

1. Maximum ambient temperature not greater than 50 degrees C.
2. Motors shall be suitable for operating conditions without any reduction being required in the nameplate rated horsepower or exceeding the rated temperature rise.
3. Overspeed in either direction in accordance with NEMA MG 1.

2.03 MOTOR HORSEPOWER RATING

A. As sized by the Membrane System Equipment manufacturer.

B. Brake horsepower of the driven equipment at any operating condition not to exceed motor nameplate horsepower rating, excluding any service factor.

2.04 MOTOR SERVICE FACTOR

A. Inverter Duty Motors: 1.00 minimum when operated at constant speed at rated ambient temperature, unless otherwise indicated.

B. Other Motors: 1.15 minimum when operated at constant speed at rated ambient temperature, unless otherwise indicated.

2.05 MOTOR VOLTAGE AND FREQUENCY RATING

A. 1/2 hp through 400 hp, 460V, three-phase, 60-Hz.

B. Less than 1/2 hp and smaller, 115V, single-phase, 60-Hz.

C. Suitable for full voltage starting.

D. 50 hp and larger also suitable for reduced voltage starting with 65 percent or 80 percent voltage tap settings on reduced inrush motor starters.

E. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

2.06 MOTOR EFFICIENCY AND POWER FACTOR

A. For all motors except single-phase, under 1 hp, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:

1. Efficiency:
   a. Tested in accordance with NEMA MG 1, Paragraph 12.58.
   b. Guaranteed minimum at full load in accordance with NEMA MG 1 Table 12-12, Full-load Efficiencies for NEMA Premium Efficiency Electric Motors Rated 600 Volts or Less (Random Wound), or as indicated in motor-driven equipment specifications.
2. Power Factor: Manufacturer’s standard.

2.07 MOTOR LOCKED ROTOR RATINGS

A. Locked rotor kVA Code F or lower, if motor horsepower not covered by NEMA MG 1 tables.

B. Safe stall time 12 seconds or greater.

2.08 MOTOR INSULATION SYSTEMS

A. Single-Phase, Fractional Horsepower Motors: Manufacturer’s standard winding insulation system.

B. Three-Phase and Integral Horsepower Motors: Unless otherwise indicated in motor-driven equipment specifications, Class F with Class B rise at nameplate horsepower and designated operating conditions.

2.09 MOTOR ENCLOSURE

A. Enclosure to conform to NEMA MG 1.

B. TEFC: Furnish with a drain hole with porous drain/weather plug.

C. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Article Special Motors.

2.10 MOTOR TERMINAL (CONDUIT) BOXES

A. Oversize main terminal boxes for all motors.

B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.

C. Furnish gaskets between box halves and between box and motor frame.

D. Minimum usable volume in percentage of that specified in NEMA MG 1, Section 1, Paragraph 4.19 and NFPA 70, Article 430:

Terminal Box Usable Values		
Voltage	**Horsepower**	**Percentage**
Below 600	15 through 125	500

E. Terminal for connection of equipment grounding wire in each terminal box.

2.11 BEARINGS AND LUBRICATION

A. Horizontal Motors:

1. 1/2 hp and Smaller: permanently lubricated and sealed ball bearings, or regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
2. 1 hp through 400 hp: Regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
3. Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and ABMA 11.

B. Regreasable Antifriction Bearings:

1. Readily accessible, grease injection fittings.
2. Readily accessible, removable grease relief plugs.

C. Oil Lubrication Systems:

1. Oil reservoirs with sight level gauge.
2. Oil fill and drain openings with opening plugs.
3. Provisions for necessary oil circulation and colling.

D. Bearing Isolation: Motors rated for inverter duty shall have one set of electrically isolated bearings to prevent stray current damage.

2.12 SPECIAL MOTORS

A. Requirements in this article take precedence over conflicting features specified elsewhere in this Section.

B. Chemical Industry, Severe-Duty (CISD-TEFC):

1. In accordance with IEEE 841.
2. TEFC in accordance with NEMA MG 1.
3. Suitable for indoor or outdoor installation in severe-duty applications including high humidity, chemical (corrosive), dirty, or salty atmospheres.
4. Motor Frame, End Shields, Terminal Box, and Fan Cover: Cast iron.
5. Ventilating Fan: Corrosion-resistant, nonsparking, external.
6. Drain and Breather Fittings: Stainless steel.
7. Nameplate: Stainless steel.
8. Gaskets between terminal box halves and terminal box and motor frame.
9. Extra slinger on rotor shaft to prevent moisture seepage along shaft into motor.
10. Double shielded bearings.
11. 125,000 hours minimum L-10 bearing life for direct-connected loads.
12. External Finish: Double-coated epoxy enamel.
13. Coated rotor and stator air gap surfaces.
14. Insulation System, Windings, and Connections:
    a. Class F insulation, Class B rise or better at 1.0 service factor.
    b. Multiple dips and bakes of nonhygroscopic polyester varnish.
15. Service Factor:
    a. At 40 Degrees C Ambient: 1.15.
    b. At 65 Degrees C Ambient: 1.00.
16. Safe Stall Time without Injurious Heating: 20 seconds minimum.

C. Inverter Duty Motor:

1. Motor supplied power by adjustable voltage and variable frequency drives shall be inverter duty rated.

2. Shaft Grounding Ring: Motors larger than 20 hp shall be provided with shaft grounding brush or conductive microfiber shaft grounding ring. Shaft grounding device shall be solidly bonded to grounded motor frame per manufacture's recommendations.
   a. Manufacturers:
      1) Grounding Brush: Sohre Turbomachinery, Inc.
      2) Grounding Ring: EST-Aegis.
3. Motor shall be suitable for operation over entire speed range indicated.
4. Provide forced ventilation where speed ratio is greater than published range for motor being installed.
5. Motors 25 hp and larger shall have thermal protection in the form of a thermostat installed. Thermostat leads shall be brought to motor terminal box.

2.13 CONDUCTORS 1,000 VOLTS AND BELOW

A. Conform to applicable requirements of NEMA WC 70.

B. Conductor Type: Stranded copper.

C. Insulation: Type XHHW-2, except 120V ac and dc control circuits shall be THWN-2.

D. Flexible Cords and Cables:

1. Type SOW-A/50 with ethylene rubber insulation in accordance with UL 62.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.14 600-VOLT RATED CABLE

A. General:

1. Type TC, Meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
2. Permanently and legible marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Type 3, No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.

1. Outer Jacket: 45-mil nominal thickness.
2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
3. Dimensions: 0.31-inch nominal OD.
4. Conductors:
    a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    b. 20 AWG, seven-strand tinned copper drain wire.
    c. Insulation: 15-mil nominal PVC.
    d. Jacket: 4-mil nominal nylon.
    e. Color Code: Pair conductors, black and red.

2.15 MOLDED CASE CIRCUIT BREAKER THERMAL MAGNECTIC, LOW VOLTAGE

A. General:

1. Type: Molded case.
2. Trip Ratings: 15 amps to 800 amps.
3. Voltage Ratings: 120, 240, 277, 480, and 600V ac.
4. Suitable for mounting and operating in any position.
5. NEMA AB 1 and UL 489.

B. Operating Mechanism:

1. Overcenter, trip-free, toggle type handle.
2. Quick-make, quick-break action.
3. Locking provisions for padlocking breaker in OPEN position.
4. ON/OFF and TRIPPED indicating positions of operating handle.
5. Operating handle to assume a center position when tripped.

C. Trip Mechanism:

1. Individual permanent thermal and magnetic trip elements in each pole.
2. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
3. Two and three pole, common trip.
4. Automatically opens all poles when overcurrent occurs on one pole.
5. Test button on cover.
6. Calibrated for 40 degrees C ambient, unless shown otherwise.
7. Do not provide single-pole circuit breakers with handle ties where multi-pole circuit breakers are shown.

D. Short Circuit Interrupting Ratings:

1. Not less than the following RMS symmetrical currents for the indicated trip ratings:
   a. Less than 250V ac: 10,000 amps.
   b. 250 to 600V ac: 22,000 amps.

E. Accessories: Shunt trip, auxiliary switches, handle lock ON devices, mechanical interlocks, key interlocks, unit mounting bases, double lugs as shown or otherwise required. Shunt trip operators shall be continuous duty rated or have coil-clearing contacts.

F. Connections:

1. Supply (line side) at either end.
2. Mechanical wire lugs, except crimp compression lugs where shown.
3. Lugs removable/replaceable for breaker frames greater than 100 amperes.
4. Suitable for 75 degrees C rated conductors without derating breaker or conductor ampacity.
5. Use bolted bus connections, except where bolt-on is not compatible with existing breaker provisions.

G. Enclosures for Independent Mounting:

1. See Article Enclosures.
2. Interlock: Enclosure and switch shall interlock to prevent opening cover with switch in the ON position. Provide bypass feature for use by qualified personnel.

2.16 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

A. Type: Heavy-duty, 30.5 mm, oil-tight. Provide contact arrangements, colors, inscriptions, and functions descriptions.

B. Contact Rating: NEMA ICS 2, Type A600.

C. Provide the following features:

1. Selector Switch Operating Lever: Standard.
2. Indicating Light: Push-to-test, transformer-type, LED.
3. Pushbutton Color:
   a. ON or START: Red.
   b. OFF or STOP: Green.

D. Legend Plate:

1. Material: Aluminum.
2. Engraving: Indicating specific function.
3. Letter Height: 6 mm.

E. Manufacturers and Products:

1. General Electric Co.; Type CR 104P.
2. Square D Co.; Type T.
3. Eaton; Type 10250T.

2.17 FUSE 0 TO 600-VOLT

A. Power Distribution, General:

1. Current-limiting, with 200,000 ampere rms interrupting rating.
2. Provide to fit mountings specified with switched.
3. UL 248.

B. Power Distribution, Ampere Ratings 1 Amp to 600 Amps:

1. Class: RK-1.
2. Type: Dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Types LPS-RK (600 volts) and LPN-RK (250 volts).
   b. Littlefuse; Types LLS-RK (600 volts) and LLN-RK (250 volts).

2.18 TERMINAL BLOCK, 600 VOLTS

A. UL 486E and UL 1059.

B. Size components to allow insertion of necessary wire sizes.

C. Capable of termination of control circuits entering or leaving equipment, panels, or boxes.

D. Screw clamp compressions, dead front barrier type, with current bar providing direct contact with wire between compression screw and yoke.

E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.

F. Yoke shall guide all strands of wire into terminal.

G. Current bar shall ensure vibration-proof connection.

H. Terminals:

1. Capable of wire connections without special preparation other than stripping.
2. Capable of jumper installation with no loss of terminal or rail space.
3. Individual, rail mounted.

I. Marking system, allowing use of preprinted or filed-marked tags.

J. Manufacturers:

1. Weidmuller, Inc.
2. Ideal.
3. Brady.

2.19 SUPPORT AND FRAMING CHANNELS

A. Carbon Steel Framing Channel (for indoor, non-corrosive applications):

1. Material: Rolled, mild strip steel, 12-gauge minimum, ASTM A1011/ A1011M, Grade 33.
2. Finish: Hot-dip galvanized after fabrication.

B. Stainless Steel Framing Channel (for outdoor or corrosive applications): Rolled, ASTM A167, Type 316 stainless steel, 12-gauge minimum.

C. Manufacturers:

1. B-Line System, Inc.
2. Unistrut Corp.
3. Aickinstrut.

2.20 ENCLOSURES

A. Finish: Sheet metal structural and enclosure parts shall be completely painted using an electrode position process so interior and exterior surfaces as well as bolted structural joints have a complete finish coat on and between them.

B. Color: Manufacturer’s standard color (gray) baked-on enamel, unless otherwise shown.

C. Barriers: Provide metal barriers within enclosures to separate wiring of different systems and voltage.

D. Enclosure Selections: The Membrane System will be located outdoors under cloth canopies and except as shown otherwise, provide electrical enclosures according to the following table:

ENCLOSURES			
Location	**Finish**	**Environment**	**NEMA 250 Type**
Indoor	Any	Dry, noncorrosive	12
Outdoor	Any	Wet and Corrosive	4X 316 Stainless Steel

2.21 FACTORY TESTING

A. Tests:

1. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.
2. Routine (production) tests on all motors in accordance with NEMA MG 1.
3. For energy efficient motors, test efficiency and power factor at 50, 75, and 100 percent of rated horsepower:
   a. In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.59 and Paragraph 12.60.
   b. Furnish a certified copy or a motor efficiency test report on an identical motor.

B. Test Report Forms:

1. Routine Tests: IEEE 112, Form A-1.
2. Efficiency and power factor by Test Method B, IEEE 112, Form A-2, and NEMA MG 1, Table 12-12.
3. Temperature Test: IEEE 112, Form A-2.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 40 27 00
PROCESS PIPING—GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section and any supplemental Data Sheets:

1. American Society of Mechanical Engineers (ASME):
   a. Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   b. B1.20.1, Pipe Threads, General Purpose (Inch).
   c. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
   d. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
   e. B16.9, Factory-Made Wrought Buttwelding Fittings.
   f. B16.11, Forged Fittings, Socket-Welding and Threaded.
   g. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
   h. B16.25, Buttwelding Ends.
   i. B31.3, Process Piping.
   j. B31.9, Building Services Piping.
   k. B36.10M, Welded and Seamless Wrought Steel Pipe.
2. American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Recommended Practice for Personal Qualification and Certification in Nondestructive Testing.
3. American Water Works Association (AWWA): C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
4. American Welding Society (AWS):
   a. D1.1/D1.1M, Structural Welding Code - Steel.
   b. QC1, Standard for AWS Certification of Welding Inspectors.
5. ASTM International (ASTM):
   a. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   b. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   c. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

d. A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
e. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
f. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
g. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
h. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
i. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
j. A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
k. A563, Standard Specification for Carbon and Alloy Steel Nuts.
l. A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
m. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
n. D1330, Standard Specification for Rubber Sheet Gaskets.
o. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
p. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
q. D2464, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
r. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
s. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
t. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
u. F436, Standard Specification for Hardened Steel Washers.
v. F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
w. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
x. F441/F441M, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
y. F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

z. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

6. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminating Thermosetting Products.

1.02 DEFINITIONS

A. Submerged or Wetted:

1. Zone below elevation of:
   a. Top face of channel walls and cover slabs.
   b. Top of tank wall or under tank covers.

1.03 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.

1.04 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Independent Inspection and Testing Agency:
   a. Ten years' experience in field of welding and welded pipe and fittings' testing required for this Project.
   b. Calibrated instruments and equipment, and documented standard procedures for performing specified testing.
   c. Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.
   d. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.
   e. Verification Welding Inspector: AWS QC1 Certified.
2. Welding Procedures: In accordance with ASME BPVC SEC IX (Forms QW-482 and QW-483) or AWS D1.1/D1.1M (Annex N Forms).
3. Welder Qualifications: In accordance ASME BPVC SEC IX (Form QW-484) or AWS D1.1/D1.1M (Annex N Forms).

4. Contractor's CWI: Certified in accordance with AWS QC1, and having prior experience with specified welding codes. Alternate welding inspector qualifications require approval by Engineer.
5. Solvent Welder for Double Wall Containment Piping: Qualified in accordance with Chapter VII of the ASME B31.3 Code, Part 9, Paragraph A328.

1.06 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 01, Product Requirements, and:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 PIPING

A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as Supplements.

B. Diameters Shown:

1. Standardized Products: Nominal size.
2. Fabricated Steel Piping: Outside diameter, ASME B36.10M.

2.02 JOINTS

A. Flanged Joints:

1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced cast or ductile iron flanges.
2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

B. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

2.03 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.04 PIPE CORROSION PROTECTION

A. Coatings: See Article Coating Systems.

B. Insulating Flanges, Couplings, and Unions:

1. Materials:
   a. In accordance with applicable piping material specified in Pipe Data Sheet. Complete assembly shall have ASME B31.9 working pressure rating equal to or higher than that of joint and pipeline.
   b. Galvanically compatible with piping.
   c. Resistant for intended exposure, operating temperatures, and products in pipeline.
2. Union Type, 2 Inches and Smaller:
   a. Screwed or solder-joint.
   b. O-ring sealed with molded and bonded insulation to body.
3. Flange Type, 2-1/2 Inches and Larger:
   a. Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.
   b. Bolt insulating sleeves shall be provided full length between insulating washers.
   c. Ensure fit-up of components of insulated flange assembly to provide a complete functioning installation.
   d. AWWA C207 steel flanges may be drilled oversize up to 1/8-inch to accommodate insulating sleeves.
   e. No less than minimum thread engagement in accordance with specified bolting standards will be permitted to accommodate thicknesses of required washers, flanges, and gasket.
4. Flange Insulating Kits:
   a. Gaskets: Full-face, Type E with elastomeric sealing element. Sealing element shall be retained in a groove within retainer portion of gasket.
   b. Insulating Sleeves: Full-length mylar or fiberglass reinforced epoxy (NEMA LI-1, G-10 grade).
   c. Insulating Washers: High-strength phenolic or fiberglass-reinforced epoxy (NEMA LI-1, G-10 grade).
   d. Steel Washers: Plated, hot-rolled steel or hardened steel, ASTM F436, 1/8-inch-thick.
      1) Flange Diameters 36 Inches or Less: Provide two washers per bolt.
      2) Flange Diameters Larger than 36 Inches: Provide four washers per bolt.
5. Manufacturers and Products:
   a. Dielectric Flanges and Unions:
      1) PSI, Houston, TX.
      2) Advance Products and Systems, Lafayette, LA.

b. Insulating Couplings:
   1) Dresser; STAB-39.
   2) Baker Coupling Company, Inc.; Series 216.

2.05 VENT AND DRAIN VALVES

A. Pipeline 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless shown otherwise.

B. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless shown otherwise.

2.06 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer's identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

C. Shop fabricate flanged pipe in shop, not in field, and delivered to Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by manufacturer.

2.07 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

3.02 PREPARATION

A. See Piping Schedule for additional requirements.

B. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

C. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

D. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's instructions**.**

3.03 WELDING

A. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by piping or fitting manufacturer.

B. Weld Identification: Keep paper record of which welder welded each joint.

C. Pipe End Preparation:

1. Machine Shaping: Preferred.
2. Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
3. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
2. Root Opening of Joint: As stated in qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:

1. Do not perform welding if there is impingement of any rain, snow, sleet, or wind exceeding 5 mph on the weld area, or if ambient temperature is below 32 degrees F.
2. Stainless Steel and Alloy Piping: If ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required.

G. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting soundness of weld.

I. Weld Quality: Meet requirements of governing welding codes.

3.04 PIPE CORROSION PROTECTION

A. Carbon Steel Pipe:

1. Exposed: See Article Coating Systems.

B. PVC and CPVC Pipe, Exposed: See Article Coating Systems.

C. Piping Accessories: Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.

D. Insulating Flanges, Couplings, and Unions:

1. Applications:
   a. Dissimilar metal piping connections.
   b. Where required for electrically insulated connection.
2. Pipe Installation:
   a. Insulating joints connecting immersed piping to nonimmersed piping shall be installed above maximum water surface elevation.
   b. Align and install insulating joints as shown on Drawings and according to manufacturer’s recommendations. Bolt lubricants that contain graphite or other metallic or electrically conductive components that can interfere with the insulating capabilities of the completed flange shall not be used.

3.05 COATING SYSTEMS

A. The following coatings requirements are listed as a minimum. Coatings applied that exceed the listed thickness and are of similar type for appropriate application are acceptable as an alternate. Determination of acceptability will be at the sole discretion of the Engineer.

B. Definitions:

Acrylic Latex (Flat)	Flat latex
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
SFPGPC	Square Feet per Gallon per coat
MDFT	Minimum dry film thickness, mils
SP 10	Surface preparation 10, Near White Blast Cleaning, as defined by the Society for Protective Coatings (SSPC)

C. System No. 5 Exposed Metal—Mildly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Factory apply on the following items or areas:
   a. Exposed metal surfaces located inside or outside of structures and exposed to weather or in a highly humid atmosphere, such as pipe galleries and similar areas, and the following specific surfaces:
      1) Carbon steel piping, all valves, piping accessories.
      2) Ferrous metals on equipment, including baseplates, equipment, and accessories.

D. System No. 25 Exposed FRP, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
Hand Sand with medium grit sandpaper	Acrylic Latex Flat	2 coats, 320 SFPGPC

1. Factory apply on the following items or areas:
   a. All exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

3.06 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Application and Installation: As specified in Section 40 27 01, Process Piping Specialties.

3.07 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including first block valve in the line carrying the lower pressure, unless otherwise shown.

C. Threaded Pipe Tap Connections:

1. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.
2. Limitations: Threaded taps in pipe barrel are unacceptable.

3.08 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines at all low and high point locations.

3.09 FACTORY QUALITY CONTROL

A. Pressure Leakage Testing: Hydrostatically test pipe assemblies prior to shipment to jobsite. Piping will be retested on site by Contractor.

B. Minimum Duties of Welding Inspector:

1. Job material verification and storage.
2. Qualification of welders.
3. Certify conformance with approved welding procedures.
4. Maintenance of records and preparation of reports in a timely manner.
5. Notification to Engineer of unsatisfactory weld performance within 24 hours of weld test failure.

C. Required Weld Examinations:

1. Perform examinations in accordance with Piping Code ASME B31.3.
2. Perform examinations for every pipe thickness and for each welding procedure, progressively, for piping covered by this section.

3. Examine at least one of each type and position of weld made by each welder or welding operator.
4. For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

3.10 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Piping Schedule.
2. Data Sheets.

Number	Title
40 27 00.08	Stainless Steel Pipe and Fittings—General Service
40 27 00.10	Polyvinyl Chloride (PVC) Pipe and Fittings
40 27 00.11	Chlorinated Polyvinyl Chloride (CPVC) Pipe and Fittings

END OF SECTION

PIPING SCHEDULE

Service	Size(s) (In.)[1]	Exposure	Piping Material	Specification Section	Joint Type	Coating[2]	Operating Pressure (Test Pressure), psi	Remarks
AHP	<2"	ALL	SST	40 27 00.08	W, FL	none	100 max, (150 max)	
ALP	ALL	EXP, SUB, BWS	SST	40 27 00.08	W, FL	none	TBD, (20) min	No field welding allowed.
	ALL	BWS	CPVC	40 27 00.11	SW, FL	25	TBD, (20) min	Optional; For use only if max blower discharge temp < 170 F
CHEM	ALL	ALL	PVC	40 27 00.10	SW, FL	25	80 psi max, (120 max)	Preliminary selection, dependent on chemical compatibility
PER	ALL	ALL	SST	40 27 00.08	W, FL	none	TBD, (TBD)	No Field Welding Allowed.

[1]">" Greater Than
"<" Less Than
"<=" Less Than or Equal To
">=" Greater Than or Equal To
"All" All Sizes

[2]Coating system number as specified in Section 40 27 00.

SERVICE

AHP	Air-High Pressure
ALP	Air-Low Pressure
CHEM	Chemical (for cleaning)
PER	Permeate

JOINT TYPE

FL	Flanged
SW	Solvent Welded
W	Welded

MATERIAL

CPVC	Chlorinated PVC
PVC	Polyvinyl Chloride
SST	Stainless Steel

EXPOSURE

ALL	All
EXP	Exposed
SUB	Submerged
BWS	Below Operating Water Surface

SECTION 40 27 00.08 STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE		
Item	**Size**	**Description**
Pipe	2-1/2" & smaller	Schedule 40S: ASTM A312/A312M, Type 316 seamless, pickled and passivated.
	3" thru 6"	Schedule 10S: ASTM A778, “as-welded” grade, Type 316L, pickled and passivated.
	8" & larger	Schedule 5S: ASTM A778, “as-welded” grade, Type 316L, pickled and passivated.
Joints	1-1/2" & smaller	Threaded or flanged at equipment as required or shown.
	2" & larger	Butt-welded or flanged at valves and equipment.
Fittings	1-1/2" & smaller	Threaded: Forged 1,000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150, ASTM A351/A351M, CF8M/316.
	2" & 2-1/2"	Butt Welded: ASTM A403/A403M, Grade WP316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
	3" & larger	Butt-Welded: ASTM A774/A774M Grade 316L conforming to MSS SP 43, “as-welded” grade, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
Branch Connections	1-1/2" & smaller	Tee or reducing tee in conformance with fittings above.
	2" & larger	Butt-welding tee or reducing tee in accordance with fittings above.

SECTION 40 27 00.08 STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE		
Item	**Size**	**Description**
Flanges	All	Forged Stainless Steel: ASTM A182/ A182M, Grade F316L, ASME B16.5 Class 150 or Class 300, slip-on weld neck or raised face. Weld slip-on flanges inside and outside. Cast Carbon Steel: ASTM A216/A216M Grade WCA, drilled, ASME B16.5 Class 150 or Class 300 Van Stone Type with stainless steel stub ends, ASTM A240 Type 316L “as-welded grade”, conforming to MSS SP 43, wall thickness same as pipe. Blind Flanges, exposed to the atmosphere and not buried nor immersed in liquid, may be either stainless steel or Class 125 ductile iron or Class 150 carbon steel with gaskets as specified herein.
Unions	2" & smaller	Threaded Forged: ASTM A182/A182M, Grade F316, 2,000-pound or 3,000-pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.
Bolting	All	Forged Flanges: Type 316 stainless steel, ASTM A320/A320M Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

SECTION 40 27 00.08 STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE		
Item	**Size**	**Description**
		Van Stone Flanges and anywhere mating flange on equipment is cast iron and gasket is flat ring: Carbon steel ASTM A307 Grade B hex head bolts, ASTM A563 Grade A hex head nuts and ASTM F436/ F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress. Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/ A320M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
Gaskets	All Flanges	Flanged, Water, Hot Air, Fuel Gas and Sewage Services: 1/8 inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.
Thread Lubricant	2" & smaller	General Service: 100 percent virgin PTFE Teflon tape.

END OF SECTION

SECTION 40 27 00.10 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		
Item	**Size**	**Description**
Pipe	All	Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded Nipples: Schedule 80 PVC.
Fittings	All	Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling.
Bolting	All	Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress. With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
Gaskets	All	Flat Face Mating Flange: Full faced 1/8-inch-thick ethylene propylene (EPR) rubber. Raised Face Mating Flange: Flat ring 1/8-inch-thick ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.

SECTION 40 27 00.10 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		
Item	**Size**	**Description**
Solvent Cement	All	Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service, IPS Weld-On 724, or approved equal. Certification shall be submitted.
Thread Lubricant	All	Teflon Tape.

END OF SECTION

SECTION 40 27 00.11
CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS

Item	Size	Description
Pipe	All	Schedule 80 CPVC: Type IV, Grade I or Class 23447-B conforming to ASTM D1784 and ASTM F441/F441M. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded nipples shall be Schedule 80.
Fittings	All	Schedule to Match Pipe Above: Conforming to the requirements of ASTM F439 for socket weld type and Schedule 80 ASTM F437 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One piece, molded hub Type CPVC flat face flange in accordance with Fittings above; ASME B16.1, Class 125 drilling.
Bolting	All	Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress. Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

SECTION 40 27 00.11 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS		
Item	**Size**	**Description**
Gaskets	All	Flat Face Mating Flange: Full faced 1/8-inch-thick ethylene propylene (EPR) rubber. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.
Solvent Cement	All	All socket type joints shall be made employing primer and solvent cements that meet or exceed the requirements of ASTM F493 and primers that meet or exceed the requirements of ASTM F656, resistant to the fluid service, and as recommended by the pipe and fitting manufacturer.
Thread Lubricant	All	Teflon tape.

END OF SECTION

SECTION 40 27 01
PROCESS PIPING SPECIALTIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
   b. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
2. American Water Works Association (AWWA):
   a. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
   b. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
   c. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
   d. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   e. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   f. Manual M11, Steel Pipe—A Guide for Design and Installation.
3. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
4. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
5. NSF International (NSF):
   a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
   b. NSF/ANSI 372, Drinking Water System Components - Lead Content.

1.02 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide required piping specialty items, as required by applicable codes and standard industry practice.

B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded, screwed, and flanged pipe joints are not considered flexible.

2.02 COUPLINGS

A. General:

1. Couplings shall be rated for working pressure not less than indicated in Piping Schedule for the service and not less than 150 psi.
2. Unless thrust restraint is provided by other means, couplings shall be harnessed in accordance with requirements of AWWA Manual M11 or as shown on Drawings.
3. Sleeve type couplings shall conform to AWWA C219 and shall be hydraulically expanded beyond minimum yield for accurate sizing and proofing of tensile strength. Couplings shall be Type 316 stainless steel. Followers shall be Type 304 stainless steel.

B. Flexible Sleeve Type Coupling:

1. Manufacturers and Products:
   a. Steel Pipe:
      1) Dresser Piping Specialties; Style 38.
      2) Smith-Blair, Inc.; Style 411.
   b. Ductile Iron Pipe:
      1) Dresser Piping Specialties; Style 253.
      2) Smith-Blair, Inc.; Style 441.

C. Transition Coupling for Steel Pipe:

1. Manufacturers and Products:
   a. Dresser Piping Specialties; Style 162.
   b. Smith-Blair, Inc.; Style 413.

D. Flanged Coupling Adapter:

1. Anchor studs where required for thrust restraint.
2. Manufacturers and Products:
   a. Steel Pipe:
      1) Dresser Piping Specialties; Style 128.
      2) Smith-Blair, Inc.; Style 913.
   b. Ductile Iron Pipe:
      1) Dresser Piping Specialties; Style 128.
      2) Smith-Blair, Inc.; Style 912.

E. Restrained Flange Adapter:

1. Pressure Rating:
   a. Minimum Working Pressure Rating: Not less than 150 psi.
   b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
2. Thrust Restraint:
   a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
   b. Products employing set screws that bear directly on pipe will not be acceptable.
3. Manufacturer and Product: EBAA Iron Sales Co.; Mega-Flange.

F. Restrained Dismantling Joints:

1. Pressure Rating:
   a. Minimum working pressure rating shall not be less than rating of the connecting flange.
   b. Proof testing shall conform to requirements of AWWA C219 for bolted couplings.
2. Manufacturers and Products:
   a. Dresser Piping Specialties; Style 131.
   b. Smith Blair, Inc.; Model 975.

G. Exposed Metallic Piping Plain End Couplings:

1. Plain end pipe couplings shall be self-restrained against hydrostatic thrust forces equal to not less than two times the working pressure rating of the coupling. Couplings shall accommodate 4 degrees angular deflection at the time of installation and subsequent to pressurization.
2. Casing, bolts, and nuts shall be Type 304 or Type 316 stainless steel. The sealing sleeve shall be EPDM or NBR elastomer as best suited for the fluid service.

3. Couplings Manufacturer and Products:
   a. Straub Couplings; Grip-L.
   b. Metal Grip.
   c. "Or-equal."

2.03 EXPANSION JOINTS

A. Elastomer Bellows:

1. Type: Reinforced molded wide arch.
2. End Connections: Flanged, drilled 125-pound ASME B16.1 standard, with split galvanized steel retaining rings.
3. Washers: Over retaining rings to help provide leak-proof joint under test pressure.
4. Thrust Protection: Control rods to protect the bellows from overextension.
5. Bellows Arch Lining: Buna-N, nitrile, or butyl.
6. Rated Temperature: 250 degrees F.
7. Rated Deflection and Pressure:
   a. Lateral Deflection: 3/4 inch, minimum.
   b. Burst Pressure: Four times the working pressure.
   c. Compression deflection and minimum working pressure as follows:

Size (inch)	Deflection (inch)	Pressure (psig)
2-1/2 to 12	1.06	150
14	1.65	130
16 to 20	1.65	110

8. Manufacturers and Products:
   a. General Rubber Corp.; Style 1015 Maxijoint.
   b. Mercer; Flexmore Style 450.
   c. Goodall Rubber Co.; Specification E-711.
   d. Unisource Manufacturing, Inc.; Series 1500.
   e. Proco Products, Inc.; Series 251.

B. Metal Bellows:

1. Type: Single-ply, annular corrugated metal bellows with limit rods. Circumferential convolution welds not permitted.
2. Material: Type 316 stainless steel.
3. End Connections: ASME 150-pound carbon steel flanges.

4. Minimum Design Working Pressure: 50 psig at 300 degrees F.
5. Length: Minimum of eight convolutions and minimum axial compression of 3/4 inches.
6. Manufacturers and Products:
   a. U.S. Bellows, Inc.; Universal Tied expansion joint.
   b. Metraflex, Model MN.
   c. Senior Flexonics Pathway, Inc.; Expansion Joints.

2.04 MISCELLANEOUS SPECIALTIES

A. Strainers, Water Service, 2 Inches and Smaller:

1. Type: Bronze body, Y-pattern, 200 psi nonshock rated, with screwed gasketed bronze cap.
2. Screen: Heavy-gauge Type 304 stainless steel or monel, 20-mesh.
3. Manufacturers and Products:
   a. Armstrong International; Inc.; Model F.
   b. Mueller Steam Specialty; Model 351M.

B. Strainers, Water Service, 2-1/2 Inches and Larger:

1. Type: Cast iron or ductile iron body, Y-pattern, 175 psi nonshock rated, with flanged gasketed iron cap.
2. Screen: Heavy-gauge Type 316 stainless steel, 0.045-inch perforations.
3. Manufacturer and Product: Armstrong International, Inc.; Model A7FL 125.

C. Strainers, Plastic Piping Systems, 4 Inches and Smaller:

1. Type: Y-pattern PVC body, 150 psi nonshock rated, with screwed PVC cap and Viton seals.
2. End Connections: Screwed or solvent weld, 2 inches and smaller. Class 150 ANSI flanged, 2-1/2 inches and larger.
3. Screen: Heavy-gauge PVC, 1/32-inch mesh, minimum 2 to 1 screen area to pipe size ratio.
4. Manufacturer: Hayward.

PART 3 EXECUTION

3.01 GENERAL

A. Provide accessibility to piping specialties for control and maintenance.

3.02 PIPING FLEXIBILITY PROVISIONS

A. General:

1. Thrust restraint shall be provided as specified in Section 40 27 00, Process Piping—General.
2. Install as indicated herein. For piping specialties to be installed in the field, coordinate with installing Contractor to ensure that piping specialties installations are in accordance with manufacturer's requirements and as specified herein.
3. Install flexible couplings to facilitate piping installation, in accordance with approved Shop Drawings.

3.03 PIPING TRANSITION

A. Applications:

1. Provide complete closure assembly where pipes meet other pipes or structures.
2. Elastomer sleeves bonded to pipe ends are not acceptable.

B. Installation:

1. Flexible Transition Couplings: Install in accordance with coupling manufacturer’s instructions to connect dissimilar pipe and pipes with a small difference in outside diameter.

3.04 PIPING EXPANSION

A. Piping Installation: Allow for thermal expansion due to differences between installation and operating temperatures.

B. Expansion Joints:

1. Grooved Joint and Flanged Piping Systems: Elastomer bellows expansion joint.
2. Screwed and Soldered Piping Systems: Copper or galvanized and black steel pipe expansion compensator, as applicable.
3. Air and Water Service above 120 Degrees F: Metal bellows expansion joint or elastomer bellows if temperature and deflection limits not exceeded.

3.05 COUPLINGS

A. General:

1. Install in accordance with manufacturer’s written instructions.

2. Before coupling, clean pipe holdback area of oil, scale, rust, and dirt.
3. Application:
    a. Metallic Piping Systems: Flexible couplings, transition couplings, and flanged coupling adapters.

END OF SECTION

SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gas Association (AGA): 3, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids.
2. American National Standards Institute (ANSI): Z21.15, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
3. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.44, Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi.
4. American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
5. American Water Works Association (AWWA):
   a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C500, Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
   d. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
   e. C509, Resilient-Seated Gate Valves for Water Supply Service.
   f. C510, Double Check Valve Backflow Prevention Assembly.
   g. C511, Reduced-Pressure Principle Backflow Prevention Assembly.
   h. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   i. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
   j. C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
   k. C542, Electric Motor Actuators for Valves and Slide Gates.
   l. C550, Protective Interior Coatings for Valves and Hydrants.
   m. C606, Grooved and Shouldered Joints.
   n. C800, Underground Service Line Valves and Fittings.

6. ASTM International (ASTM):
    a. A276, Standard Specification for Stainless Steel Bars and Shapes.
    b. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
    c. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
    d. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
    e. B61, Standard Specification for Steam or Valve Bronze Castings.
    f. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
    g. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
    h. B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
    i. B139/B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
    j. B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
    k. B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
    l. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
    m. D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
    n. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
7. Canadian Standards Association, Inc. (CSA): 9.1, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
8. Chlorine Institute (CI): Pamphlet 6, Piping Systems for Dry Chlorine.
9. FM Global (FM).
10. Food and Drug Administration (FDA).
11. International Association of Plumbing and Mechanical Officials (IAPMO).
12. Manufacturers Standardization Society (MSS):
    a. SP-80, Bronze Gate, Globe, Angle, and Check Valves.
    b. SP-81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.
    c. SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.
    d. SP-88, Diaphragm Valves.
    e. SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

13. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
14. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
15. UL.
16. USC Foundation for Cross-Connection Control and Hydraulic Research.

1.02 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

B. Action Submittals:

1. Shop Drawings:
    a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
    b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
    c. Power and control wiring diagrams, including terminals and numbers.
    d. For each power actuator provided, manufacturer's standard data sheet, with application specific features and options clearly identified.
    e. Sizing calculations for open-close/throttle and modulating valves.

C. Informational Submittals:

1. Tests and inspection data.
2. Operation and Maintenance Data as specified in Section 01 30 00, Administrative Requirements.
3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, operating nut, worm and gear operator, chain, wrench, and all accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise.

H. Factory mount operator, actuator, and accessories.

2.02 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

2.03 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.
2. Exterior coating for valves and hydrants shall be in accordance with System No. 5 as specified in Section 40 27 00, Process Piping—General.
3. Exposed safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be “safety yellow.”

B. Where epoxy lining and coating are specified, factory finishing shall be as follows:

1. In accordance with AWWA C550.

2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2.04 VALVES

A. Gate Valves:

1. General:
   a. AWWA gate valves to be in full compliance with stated AWWA standard and the following requirements:
      1) Provide 2-inch operating nut and handwheel for AWWA gate valves 12 inches and smaller.
      2) Provide totally enclosed spur or bevel gear operator with indicator for AWWA gate valves 14 inches and larger.
      3) Provide Affidavit of Compliance per the applicable AWWA standard for AWWA gate valves.
      4) Mark AWWA gate valves with manufacturer’s name or mark, year of valve casting, valve size, and working water pressure.
      5) Repaired AWWA gate valves shall not be submitted or supplied.
2. Type V110 Gate Valve 2 Inches to 24 Inches:
   a. Iron body, bronze mounted, flanged ends, solid wedge gate, outside screw and yoke, Class 125 rated 125 psi SWP, 200 psi CWP for 2 inches through 12 inches and 100 psi SWP, 150 psi CWP for 14 inches through 24 inches.
   b. Manufacturers and Products:
      1) Crane; Figure 465-1/2.
      2) Stockham; Figure G623.
3. Type V130 Resilient Seated Gate Valve 3 Inches to 12 Inches:
   a. Iron body, resilient seat, bronze stem and stem nut, ASME B16.1 Class 125 flanged ends, outside screw and yoke, in accordance with AWWA C509, minimum design working water pressure 200 psig, full port, fusion-epoxy coated inside and outside per AWWA C550.
   b. Manufacturers and Products:
      1) M&H Valve; AWWA C509.
      2) U.S. Pipe; A-USPO.

B. Ball Valves:

1. Type V300 Ball Valve 3 Inches and Smaller for General Water and Air Service:
   a. Two-piece, standard port, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Threaded:
         a) Conbraco Apollo; 70-100.
         b) Nibco; T-580-70.
      2) Soldered:
         a) Conbraco Apollo; 70-200.
         b) Nibco; S-580-70.
2. Type V302 Actuator Ready Ball Valve 2 Inches and Smaller for General Water and Air Service:
   a. Two-piece, standard port, NPT threaded ends, bronze body and end piece, actuator mounting pad, Type 316 stainless steel ball and stem, vented ball, reinforced PTFE seats and seals, adjustable packing nut, blowout-proof stem, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Conbraco Apollo; 71-140.
      2) Milwaukee; 20BSOR-02.
3. Type V303 Ball Valve 2 Inches and Smaller for Equipment Air System Shutoff:
   a. Two-piece, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, 125 psig rated, safety exhaust port to exhaust downstream side when valve is in closed position, zinc-coated steel locking handle with vinyl grip.
   b. Meets OSHA Regulation 29 CFR Part 1910.147 requirements.
   c. Manufacturers and Products:
      1) Conbraco Apollo; 75-100-41.
      2) Nibco; T-580-70-SV/T-585-70-SV.
4. Type V306 Stainless Steel Ball Valve 2 Inches and Smaller:
   a. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 1,000 psig CWP, complies with MSS SP-110.

b. Manufacturers and Products:
   1) Conbraco Apollo; 76F-100 Series.
   2) Nibco; T-585-S6-R-66-LL.

5. Type V309 Instrument Air Shutoff Valve 1/8 Inch to 3/4 Inch:
   a. Stainless steel body ball valve, nylon handle, tube fitting ends, PTFE seats and seals, panel nut, rated 1,500 psi minimum.
   b. Manufacturers and Products:
      1) Swagelok; 40 Series.
      2) Parker Hannifin; B Series.
6. Type V320 Vee-Ball Valve 1 Inch to 16 Inches:
   a. ASME B16.1 Class 150-pound flanged ends, carbon steel body, heat treated nickel- or hard chromium-plated Type 317 stainless steel ball, splined-type, 17-4 PH stainless steel shafts, reinforced PTFE flow-ring seal, reinforced PTFE with stainless steel or Hastalloy sleeve bearings, and PTFE V-ring packing. Valve to have 300:1 rangeability and equal percentage characteristic.
   b. Manufacturers and Products:
      1) Fisher Controls: Design V150.
      2) DeZurik: VPB V-Port Ball Valve.
7. Type V330 PVC Ball Valve 2 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O-ring stem seals, to block flow in both directions. Provide pressure relief hole drilled on low pressure side of ball for hypochlorite service.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union.
      4) "Or-equal."

C. Butterfly Valves:

1. General:
   a. In full compliance with AWWA C504 and following requirements:
      1) Suitable for throttling operations and infrequent operation after periods of inactivity.
      2) Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B.
      3) Bubble-tight with rated pressure applied from either side. Test valves with pressure applied in both directions.
      4) No travel stops for disc on interior of body.

5) Self-adjusting V-type or O-ring shaft seals.
6) Isolate metal-to-metal thrust bearing surfaces from flowstream.
7) Provide traveling nut or worm gear actuator with handwheel. Valve actuators to meet the requirements of AWWA C504.
8) Provide linings and coatings per AWWA. Wetted materials shall be constructed of a material resistant to corrosion in the intended service or coated with nylon or an 8-mils minimum dry film thickness of epoxy per AWWA C550.

b. Non-AWWA butterfly valves to meet the following actuator requirements:
1) For above ground installations, provide handle and notch plate for valves 6 inches and smaller and heavy-duty, totally enclosed gearbox type operators with handwheel, position indicator and travel stops for valves 8 inches and larger, unless otherwise specified herein.

2. Type V500 Butterfly Valve Water Works Service 3 Inches to 72 Inches:
a. AWWA C504, Class 150B.
b. Short body type, flanged ends.
c. Cast-iron body, cast or ductile iron disc, Type 304 stainless steel shafts, Buna-N rubber seat bonded or molded in body only, and stainless steel seating surface.
d. Manufacturers and Products:
1) Pratt; Model 2FII or Triton XR-70.
2) DeZurik; AWWA Valve.
e. Alternatively:
1) API 609, with lug style ends designed to mate to Class 150 flanges.
2) Cast-iron body, stainless steel disk, Buna-N rubber seat, rated to 188 psig working shutoff pressure.
3) Manufacturer and Product: ST&H corporation: STL-SR.

3. Type V510 Lug Style Butterfly Valve, Resilient Seated, 2 Inches to 20 Inches for Low Pressure Process Air Service or Clear Water Service:
a. Lug style cast-iron body, aluminum bronze discs, Type 316 stainless steel one-piece stem, self-lubricating sleeve type bushings, EPDM replaceable resilient seat suitable for operating temperatures up to 250 degrees F, 150 psi working pressure rating, bubble-tight at 50 psi differential pressure, valve body to fit between ASME B16.1 Class 125/150 flanges.
b. Manufacturers and Products:
1) Bray Controls; Series 31.
2) Tyco/Keystone; Model AR2.

4. Type V514 High Performance Butterfly Valve 2 Inches to 36 Inches:
   a. ASME B16.1 Class 150 lug style, high performance type, Type 316 stainless steel body, Type 316 stainless steel single or double offset disc, Type 316 stainless steel shaft and taper pins, EPDM seat, PTFE stem packing, stainless steel with RTFE thrust washer.
   b. Manufacturers and Products:
      1) Tyco/Keystone; K-Lok Series.
      2) DeZurik; BHP Series.
   c. Alternatively:
      1) API 609, with lug style ends designed to mate to Class 150 flanges.
      2) Stainless steel body, stainless steel disk, PTFE seat, rated to 188 psig working shutoff pressure.
      3) Manufacturer and Product: ST&H Corporation; STHL.

D. Check and Flap Valves:

1. Type V600 Check Valve 2 Inches and Smaller:
   a. All bronze, threaded cap, threaded or soldered ends, swing type replaceable bronze disc, rated 125-pound SWP, 200-pound WOG.
   b. Manufacturers and Products:
      1) Stockham; Figure B-319, threaded ends.
      2) Milwaukee; Figure 509, threaded ends.
      3) Stockham; Figure B-309, soldered ends.
      4) Milwaukee; Figure 1509, soldered ends.
2. Type V608 Swing Check Valve 2 Inches to 24 Inches:
   a. AWWA C508, 125-pound flanged ends, cast-iron body, bronze body seat, bronze mounted cast-iron clapper with bronze seat, stainless steel hinge shaft.
   b. Valves, 2 inches through 12 inches rated 175-pound WWP and 14 inches through 24 inches rated 150-pound WWP. Valves to be fitted with adjustable outside lever and weight. Increasing-pattern body valve may be used where increased outlet piping size is shown.
   c. Manufacturers and Products:
      1) M&H Valve; Style 59, 159, or 259.
      2) Mueller Co.; No. A-2600 Series.
3. Type V630 PVC Ball Check Valve 4 Inches and Smaller:
   a. ASTM D1784, Type I, Grade 1 polyvinyl chloride body, dual union socket weld ends, rated 150 psi at 73 degrees F, and Viton seat and seal.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru Union.
      2) ASAHI/America.
      3) Spears; True Union.

4. Type V632 Ball Check Valve 3 Inches and Larger:
    a. Flanged end, iron body valve with cleanout and floating or sinking type hollow steel ball, vulcanized nitrile rubber exterior, flanges ASME B16.1, Class 125, rated 150-pound working pressure, suitable for vertical up or horizontal flow.
    b. Manufacturers:
        1) FLYGT Corp.
        2) Flomatic Corp.
        3) Golden Anderson.

E. Self-Regulated Automatic Valves:

1. Type V710 Pressure-Reducing Valve 2-1/2 Inches and Smaller:
    a. Direct diaphragm operated, spring controlled, bronze body, NPT threaded ends, 200-psig rated minimum.
    b. Size/Rating: As determined by membrane manufacturer. As shown in Valve Schedule.
    c. Manufacturers and Products:
        1) Fisher; Type 75A.
        2) Watts; Series 223.
2. Type V720 PVC Pressure Relief, By-Pass Relief, Back-Pressure Regulator, Back-Pressure, Anti-Siphon Valve 1/2 Inch to 2 Inches:
    a. Direct acting diaphragm, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
    b. PVC body, Teflon or Viton diaphragm, PVC or Teflon piston, high-density polyethylene or stainless steel adjusting bolt and locknut, stainless steel or coated steel spring, stainless steel fasteners.
    c. Designed to open when upstream pressure reaches setpoint; set pressure adjustable from 10 psi to 100 psi, minimum.
    d. Manufacturers and Products:
        1) Plast-O-Matic; Series RVDT.
        2) Griffco; Series BPV.
        3) Primary Fluid Systems; TOP Valve.
3. Type V722 PVC Pressure Regulating Valve, 1/2 Inch to 1-1/2 Inches:
    a. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
    b. PVC body, Viton seals and diaphragm, coated stainless steel spring, stainless steel adjusting bolt, locknut, and fasteners.
    c. Designed to regulate downstream pressure closing when pressure reaches setpoint; set pressure adjustable from 5 psi to 50 psi.
    d. Manufacturers and Products:
        1) Plast-O-Matic, Series PR.
        2) Hayward; Pressure Regulator.

F. Miscellaneous Valves:

1. Type V940 Solenoid Valve 1/4 Inch to 2 Inches:
   a. Two-way internal pilot operated diaphragm type, brass body, resilient seat suitable for air or water, solenoid coil molded epoxy, NEMA insulation Class F, 120V ac, 60-Hz, unless otherwise indicated. Solenoid enclosure NEMA 250, Type 4 unless otherwise indicated. Size and normal position (when de-energized) as determined by Membrane Supplier.
   b. Minimum operating pressure differential no greater than 5 psig, maximum operating pressure differential not less than 125 psig.
   c. Manufacturers:
      1) ASCO.
      2) Skinner.

2.05 OPERATORS AND ACTUATORS

A. Manual Operators:

1. General:
   a. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.
   b. For non-AWWA valves, operator force not to exceed applicable industry standard or 40 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
   c. Operator self-locking type or equipped with self-locking device.
   d. Position indicator on quarter-turn valves.
   e. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator’s threaded steel reach rod with internally threaded bronze or ductile iron nut.
2. Exposed Operator:
   a. Galvanized and painted handwheel.
   b. Cranks on gear type operator.
   c. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
   d. Valve handles to take a padlock, and wheels a chain and padlock.

B. Electric Operators, 120 Volts:

1. General:
   a. Unit shall be low profile to reduce amount of required space and weigh 15 pounds or less.

b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of the valve.
c. Provide operator mounting bracket to mount operator to valve providing minimal torque to piping system when operating.
d. Controls Integral with the actuator and fully equipped as specified in AWWA 540.

2. Operator Operation, General:
   a. Suitable for full 90-degree rotation of quarter-turn valves.
   b. Manually override handwheel.
   c. Mechanical valve position indication.
3. Electronic Control:
   a. Torque Limiting Switches: Two single pole, double throw mechanical switches. Switches operate at any point in valve travel.
   b. Jammed-valve detection and protection.
   c. Motor over-temperature detection and protection.
   d. Travel limit switches, single pole double throw.
4. Open-Close (O/C) Service:
   a. Duty cycle for intermittent ON-OFF operation shall be 25 percent.
   b. Operator shall power to OPEN and power to CLOSE.
   c. Local Indication and Control:
      1) Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
      2) Integral OPENED and CLOSED indication lights.
      3) Integral LOCAL-OFF-REMOTE (L-O-R).
      4) Integral OPEN maintained switch which causes the valve to stroke full OPENED, even if OPEN switch is released, while L-O-R switch is in LOCAL.
      5) Integral CLOSE maintained switch which causes valve to stroke full CLOSED, even if CLOSED switch is released, while L-O-R switch is in LOCAL.
   d. Remote Indication and Control:
      1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
      2) Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
      3) Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.
   e. Modulating (M) Service:
      1) Operator rated for continuous duty with servo shall be rated for 100 percent modulating operation.
      2) Operator shall modulate based on an externally applied 4 mA to 20 mA dc signal.

3) Operator shall be equipped with an electronic servo module for valve modulation.
   a) Module shall provide serial communications with provided cable for setup of valve operation.

f. Local Indication and Control:
   1) Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
   2) Integral OPENED and CLOSED indication lights.
   3) Integral LOCAL-OFF-REMOTE (L-O-R).
   4) Integral OPEN momentary switch which causes valve to stroke towards OPENED, as long as OPEN switch is held, while L-O-R switch is in LOCAL.
   5) Integral CLOSE momentary switch which causes valve to stroke towards CLOSED, as long as CLOSED switch is held, while L-O-R switch is in LOCAL.
   6) Position valve proportionally 0 percent to 100 percent OPEN with external 4 mA to 20 mA dc signal while in REMOTE.

g. Remote Indication and Control:
   1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
   2) Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
   3) Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.
   4) Current Position Transmitter, 4 mA to 20 mA dc signal in proportion to 0 percent to 100 percent OPENED, with 0.5 percent accuracy and 0.5 percent repeatability, capable of driving a 750-ohm load, for connection to and monitoring by Plant Control System.

5. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule.
6. Manufacturer: Auma.

C. Electric Motor Actuators, 480 Volts:

1. General:
   a. Comply with latest version of AWWA C542.
   b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
   c. Controls integral with actuator and fully equipped as specified in AWWA C542.
   d. Stem protection for rising stem valves.

2. Actuator Operation—General:
    a. Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves, as applicable.
    b. Manual override handwheel.
    c. Valve position indication.
    d. Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in Electric Actuated Valve Schedule.
    e. Nonintrusive Electronic Control: Local controls, diagnostics, and calibration, including limit and torque settings, shall be accomplished nonintrusively. Electronic valve position display with capability to show continuous torque output. If applicable, provide two hand-held configuration units for every 10 actuators provided, two minimum.
3. Open-Close(O/C)/Throttling(T) Service:
    a. Size motors for one complete OPEN-CLOSE-OPEN cycle no less than once every 10 minutes.
    b. Actuator suitable for throttling operation of valve at intermediate positions.
    c. LOCAL-OFF-REMOTE Selector Switch, padlockable in each position:
        1) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in LOCAL position.
        2) Remote OPEN-STOP-CLOSE momentary control dry contact inputs in REMOTE position. Integral seal-in circuits for remote OPEN and CLOSE commands; valve travel stops when remote STOP contact opens.
        3) Auxiliary contact that closes in REMOTE position.
    d. OPEN and CLOSED indicating lights.
    e. Integral reversing motor starter with built-in overload protection.
4. Modulating (M) Service:
    a. Size actuators for continuous modulating duty.
    b. Feedback potentiometer, or equivalent, and integral electronic positioner/comparator circuit to maintain valve position.
    c. HAND-OFF-AUTO (Local-Off-Remote) Selector Switch, padlockable in each position:
        1) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in HAND (Local) position.
        2) 4 mA to 20 mA dc input signal to control valve in AUTO (Remote) position.
        3) Auxiliary contact that closes in AUTO (Remote) position.
    d. OPEN and CLOSED indicating lights.
    e. Ac motor with solid state reversing starter or dc motor with solid state reversing controller, and built-in overload protection. Controller capable of 1,200 starts per hour.

f. Duty cycle limit timer and adjustable band width, or equivalent, to prevent actuator hunting.
g. Valve position output converter that generates isolated 4 mA to 20 mA dc signal in proportion to valve position, and is capable of driving into loads of up to 500 ohms at 24V dc.

5. Limit Switch:
   a. Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120V ac.
   b. Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
   c. Housed in actuator control enclosure.
6. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule.
7. Manufacturer: Auma.

D. Pneumatic Actuators:

1. General:
   a. Actuator complete with air sets, exhaust mufflers, speed controls, pilot solenoids, safety vented isolation valves, and accessories.
   b. Suitable for full operation range of valve at air supply pressure indicated.
   c. Position indication and stop limiting devices on all actuators.
   d. Return valve to closed position on loss of signal.
2. Vane Style Actuator:
   a. In compliance with AWWA C541.
   b. Air supply at pressure determined by the membrane manufacturer, not to exceed 80 psi.
   c. Pressure die-cast aluminum housing with corrosion resistant fusion bonded epoxy finish, stainless steel bolting, stainless steel adjustable end stops.
   d. Electroless nickel-plated steel shaft and vane, single-component machined or cast part.
   e. Dual-opposed polyurethane lip seals with stainless steel expander.
   f. Double Acting:
      1) Complete with mounting hardware.
      2) Suitable for nonlubrication air.
   g. Spring Return:
      1) Wound stainless steel spring type in separate housing.
      2) Attached to pneumatic actuator housing.
   h. Geared Manual Override: Geared type with de-clutchable handwheel, torque rated for application.
   i. Visual Indicator: High visibility, OPEN-CLOSED indication, color coded, chemical resistant, clear polycarbonate cover.

j. Manufacturers:
   1) Kinetrol.
   2) K-Tork.
   3) Bray Controls.
   4) ST&H.

3. Cylinder Actuator:
   a. In compliance with AWWA C541.
   b. Air supply pressure at pressure determined by the membrane manufacturer, not to exceed 80 psi.
   c. Nonswivel type totally enclosed:
      1) Travel stops and position indicator.
      2) Factory lubricated and sealed requiring no additional lubrication.
   d. Double Acting:
      1) Nonmetallic for operation on nonlubricated air.
      2) Handwheel override independent of cylinder.
   e. Spring Return:
      1) Open, closed, or throttling, steel cylinder with air line lubricators. Nonlubricated air may be used if certified by manufacturer.
      2) Modulating: Nonmetallic for operation on nonlubricated air.
      3) Manual override manufacturer's standard.
   f. Actuators used on quarter-turn valves to include a totally enclosed valve actuating mechanism. Actuating mechanism to be factory lubricated and sealed.
   g. Manufacturers:
      1) Rotork.
      2) DeZurik.
4. Diaphragm Actuator:
   a. Spring return with steel or aluminum diaphragm case and spring barrel, steel spring and actuator stem, and fabric-reinforced neoprene diaphragm.
   b. Actuators used on quarter-turn valves to include a totally enclosed valve actuating mechanism. Actuating mechanism to be factory lubricated and sealed.
   c. Diaphragm actuators sized and configured for service indicated and air supply pressure of at pressure determined by the membrane manufacturer, not to exceed 35 psi.
   d. Manufacturers and Products:
      1) Fisher Controls; Type 1051.
      2) Keystone Valve; Figure 723.

5. Accessories:
    a. Air Set: Pressure regulator with internal relief, filter, outlet pressure gauge, and adjustable reduced pressure range as required by valve actuator.
        1) Aluminum body and handwheel.
        2) Safety vented lockout isolation valve.
        3) Gauge range 1-1/3 to 2 times maximum operating pressure.
        4) Manufacturers and Products:
            a) Fisher Controls; Type 67 AFR.
            b) Masoneilan; No. 77-4.
    b. Air Exhaust Muffler:
        1) In the exhaust port of actuator pilot solenoid valves.
        2) Manufacturers:
            a) Barry Wright Corp.
            b) Allied Witan Co.
    c. Limit Switch:
        1) Single-pole, double-throw (SPDT) type, rated 10 amps at 120V ac.
        2) Housed in NEMA 4X enclosure.
        3) Adjustable for OPEN and CLOSED valve positions.
    d. Positioner:
        1) For modulating actuators, shall be pneumatic force balance instruments to control valve position as a function of input signal. Accomplish positive positioning of valve by a mechanical feedback connection from valve actuating mechanism. Position feedback through a characterized linear cam to allow adjustment of valve positioning and input signal. Positioner suitable for double acting or spring return actuator.
        2) Positioner to have zero and span adjustment and be field reversible for direct or reverse action.
        3) Gauges for supply and output pressure and for input signal pressure.
        4) Positioner for 3 psig to 15 psig pneumatic input signal or 4 mA to 20 mA dc input signal as indicated.
        5) Positioner for dc input signal with transducers shall convert electrical signal to appropriate pneumatic signal. Transducer integral with positioner or separate component. If separate, factory mount transducer on pneumatic operator. Line electric power not required for transducer.
        6) Corrosion-resistant enclosures for positioners and transducers to be splash-proof and moisture-proof with gasketed covers.

e. Pilot Solenoid Valve:
   1) Solenoid valve shall pilot control actuator in appropriate configuration for type of open-close actuator being controlled. Double acting actuator shall have four-way solenoid valve, and spring return actuator shall have three-way solenoid valve. Dual coil valve shall not change position unless one coil is energized while the other is de-energized.
   2) Pilot operated diaphragm type solenoid valve with brass body and resilient seat. Valve with minimum operating pressure differential no greater than 10 psig and maximum operating pressure differential no less than 150 psig. Internal parts corrosion-resistant. Solenoid valve to have Class F molded coils for operation on 120V ac, 60-Hz, unless otherwise indicated. Solenoid enclosure as defined in NEMA 250, Type 4X.
   3) Manufacturers:
      a) Asco Red Hat.
      b) C.A. Norgren Co.

6. Open-Close and Throttling Valve:
   a. Double Acting Cylinders: Four-way solenoid with dual coils.
   b. Spring Return Cylinders: Three-way solenoids, spring return.
7. Modulating Valve: Positioner with 4 mA to 20 mA input signal.

2.06 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each valve operator, bearing valve tag number coordinated with Engineer.

B. Limit Switch: Factory installed NEMA 4X limit switch by actuator manufacturer.

C. Chain Wheel and Guide:

1. Handwheel direct-mount type.
2. Complete with chain.
3. Galvanized or cadmium-plated.
4. Manufacturers and Products:
   a. Clow Corp.; Figure F-5680.
   b. Walworth Co.; Figure 804.
   c. DeZurik Corp.; Series W or LWG.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install valves as indicated herein. For valves to be installed in the field, coordinate with installing Contractor to ensure that valve installations are in accordance with manufacturer's requirements as specified.

B. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

C. Screwed Ends:

1. Clean threads by wire brushing or swabbing.
2. Apply joint compound.

D. PVC and CPVC Valves: Install using solvents approved for valve service conditions.

E. Valve Installation and Orientation:

1. General:
   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
   b. Install valves in location for easy access for routine operation and maintenance.
   c. Install valves per manufacturer’s recommendations.
2. Gate, and Ball Valves:
   a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor.
   b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor.
3. Butterfly Valves:
   a. Unless otherwise restricted, install valve a minimum of 8 diameters downstream of a horizontal elbow or branch tee with shaft in horizontal position.
   b. For vertical elbow or branch tee immediately upstream of valve, install valve with shaft in vertical position.
   c. For horizontal elbow or branch tee immediately upstream of valve, install valve with shaft in horizontal position.
   d. When installed immediately downstream of swing check, install valve with shaft perpendicular to swing check shaft.

e. For free inlet or discharge into basins and tanks, install valve with shaft in vertical position.

4. Check Valves:
   a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.
   b. Install valve in vertical flow (up) piping only for gas services.
   c. Install swing check valve with shaft in horizontal position.
   d. Install double disc swing check valve to be perpendicular to flow pattern when discs are open.
5. Solenoid Valves: Install in accordance with manufacturer's instructions.

F. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.

G. Install safety isolation valves on compressed air.

H. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

I. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.

J. Chain Wheel and Guide: Install chain wheel and guide assemblies or chain lever assemblies on manually operated valves over 6 feet 9 inches above finish floor. Install chain to within 3 feet of finish floor. Where chains hang in normally traveled areas, use appropriate "L" type tie-back anchors. Install chains to within operator horizontal reach of 2 feet 6 inches maximum, measured from normal operator standing location or station.

3.02 TESTS AND INSPECTION

A. Perform the following tests and inspections. Where these activities occur in the field, coordinate with the installing Contractor.

B. Valve may be either tested while testing pipelines, or as a separate step.

C. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

D. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

E. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

F. Set, verify, and record set pressures for relief and regulating valves.

G. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

3.03 MANUFACTURER'S SERVICES

A. Provide the following manufacturer's services in coordination with the Contractor.

1. Assist Contractor with valve installation including valve, valve operator, and controls adjustments, valve support, valve orientation, gaskets, bolts, and connections to balance-of-plant piping provided by the Contractor.

3.04 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this Specification:

1. Valve Schedule.

END OF SECTION

VALVE SCHEDULE

Service	Isolation Valves	Control Valves and Actuated Valves	Check Valves
ALP	V510, and those listed in blower specification	V510, V514	See blower specification
PER	V514, V110, V130, V306, V500	V514, V320	V600, V608
CHEM	V330	N/A	V630
AHP	V300	V302	N/A
Note other types of valves are not listed and may be necessary for function of the Membrane System. Use the above valves when possible. Use valves listed in this specification for other applications if suitable for application.			

SECTION 40 91 00
INSTRUMENTATION AND CONTROL COMPONENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section gives general requirements for instrumentation and control components.

PART 2 PRODUCTS

2.01 GENERAL

A. Article Mechanical Systems Components covers requirements of mechanical and instrumentation and control components that are not specifically referenced by Section 43 32 56, Membrane Equipment System (Membrane Bioreactor); Section 40 99 00, Package Control System; Instrument Lists or Data Sheets.

B. All other Part 2 articles are also given as a minimum quality requirement for all instruments and components provided by package systems suppliers in addition to the requirements of Section 40 99 90, Package Control Systems, and specific package system specifications.

2.02 MECHANICAL SYSTEMS COMPONENTS

A. Manifold, Three-Valve Equalizing:

1. Type: For isolation and equalization of differential pressure transducers.
2. Materials: Stainless steel.
3. Manufacturers and Products:
   a. Anderson, Greenwood and Co.; Type M1.
   b. Evans.

B. Pressure Gauge: For other than process variable measurement.

1. Dial Size: Nominal 2-inch dial size.
2. Accuracy: 2 percent of span.
3. Scale Range: Such that normal operating pressure lies between 50 percent and 80 percent of scale range.
4. Connection: To be determined by Seller.
5. Manufacturer and Product: Ashcroft; Gauge Series 1000.

C. ON/OFF Valves:

1. Type: Ball valve.
2. Materials: Brass, stainless steel, PVC, or CPCV, as recommended by manufacturer for designated service.
3. Manufacturers and Products:
    a. Swagelok; 40/40G Series.
    b. No substitutions allowed.

D. Regulating Valves:

1. Type: Needle valves, with regulating stems and screwed bonnets.
2. Materials: Brass, stainless steel, PVC, or CPCV, as recommended by manufacturer for designated service.
3. Manufacturers and Products:
    a. Swagelok; JB and JN Series.
    b. No substitutions allowed.

E. Valve, Three-Way:

1. Type: Ball valve.
2. Materials: Brass or stainless steel with nylon handle as recommended by manufacturer for designated service.
3. Manufacturers and Products:
    a. Swagelok; 40/40G Series.
    b. No substitutions allowed.

F. Valve, Four-Way:

1. Type: Four-way, two-position ball valve.
2. Materials:
    a. Body and Stem: Type 316 stainless steel.
    b. Handle: Black nylon.
    c. Packing Gland: Teflon.
3. Ball and stem bed, one-piece assembly.
4. Machined handle stops and directional nameplates.
5. Manufacturers and Products:
    a. Swagelok; 40 Series.
    b. No substitutions allowed.

G. Spool Valve:

1. Type: Five-port arrangement as shown, two-position, push-to-operate knob attached to the spool stem, and spring return.
2. Materials: Aluminum construction with Teflon impregnated aluminum spool, stainless steel spring, and Buna-N O-rings.
3. Port Connection: 1/4-inch outside diameter tube fittings.

4. Manufacturer and Product: Norgren; K71DA00KS1KB01P2.

H. Solenoid Valve, Two-Way:

1. Type: Globe valve directly actuated by solenoid and not requiring minimum pressure differential for operation.
2. Materials:
   a. Body: Brassed or stainless steel globe valves as recommended by manufacturer for designated service.
   b. Valve Seat: Buna-N.
3. Size: To be determined by Seller.
4. Coil: 115V ac.
5. Solenoid Enclosure: NEMA 4.
6. Manufacturer and Product: ASCO; Series 262.

I. Pressure Regulator, Air:

1. Provide air at reduced pressures, as shown, constant to within plus or minus 10 percent for flows from 0 scfh to 300 scfh with 100 psi supply pressure.
2. Materials: As recommended by manufacturer for designated service.
3. Setscrew for outlet pressure adjustment.
4. Integral filter and relief valve.
5. Manufacturer and Product: Fisher; Series 67CFSR.

J. Pressure Regulator, Water:

1. Materials: As recommended by manufacturer for designated service.
2. Sizing: For maximum of 7 psi offset pressure.
3. Manufacturer and Product: Fisher; Series MR95.

K. Test Tap:

1. Manufacturers and Products:
   a. Imperial-Eastman; quick-disconnect couplings No. 292-P and caps No. 259-P.
   b. Crawford Fitting Co.; Swagelok quick-connects Series QC4 and caps QC4-DC.
   c. Parker; CPI Series precision quick couplings.

L. Copper Tubing and Fittings:

1. Type K hard copper, ASTM B88, with commercially pure wrought copper solder joint fittings. Make joints with 95-5 wire solder, ASTM B32, Grade 95 TA. Do not use cored solder.
2. Alternatively, Type K, soft temper copper tubing, ASTM B88, with brass compression type fittings may be used.

3. Manufacturer:
    a. Swagelok tube fittings.
    b. No substitutions allowed.

M. Plastic Tubing and Fittings:

1. Tubing:
    a. Polyethylene capable of withstanding 190 psig at 175 degrees F.
    b. Manufacturer and Product:
        1) Imperial Eastman; Poly-Flo black instrument tubing.
        2) "Or-equal."
2. Fittings:
    a. Type: Brass compression.
    b. Manufacturer and Product:
        1) Imperial Eastman; Poly-Flo tube fittings.
        2) "Or-equal."

N. Stainless Steel Tubing: ASTM A312/A312M, Type 316, 0.065-inch wall, seamless, soft annealed.

O. Stainless Steel Fittings:

1. Compression Type:
    a. Materials: Type 316 stainless steel, ASTM A182/A182M forged bodies or ASTM A276 barstock bodies, flareless.
    b. Manufacturer and Product:
        1) Swagelok tube fittings.
        2) No substitutions allowed.
2. Socket Weld Type:
    a. Materials: Type 316 stainless steel, ASTM A182/A182M forged bodies or ASTM A276 barstock bodies, 3,000 psi maximum working pressure, safety factor 4:1.
    b. Manufacturer:
        1) Swagelok.
        2) No substitutions allowed.

P. Air Set: Consists of a shutoff valve, pressure regulator, discharge pressure gauge, and interconnecting tubing.

Q. Purge Set:

1. Parts: Purge rotameter flow element, pressure regulator, pressure gauge, test tap, shutoff valve, spool valve, and interconnecting tubing as required in this section.
2. Pressure Gauge Scale Range: 150 percent of the process variable.

R. Tubing Raceways:

1. Cable tray systems complete with tees, elbows, reducers, and covers.
2. Size in accordance with manufacturer's recommendations for intended service.
3. Materials: Galvanized steel or aluminum brass as recommended by manufacturer for designated service.
4. Manufacturers:
   a. Globetray.
   b. Cope.

S. Air Supply Sets:

1. Parts: Integrally Mounted:
   a. Pressure Controls: Automatic START/STOP, factory set at 30 psig to 50 psig.
   b. Valves: Manual drain, manual shutoff, pressure relief, and check valve.
   c. Pressure gauge.
   d. Inlet filter muffler.
   e. Power: 120V ac.
   f. Compressor: Oilless, single cylinder, rated for at least 1 scfm at 50 psig.
   g. Manufacturers:
      1) Gardner Denver.
      2) Gast.

2.03 ANALYTICAL COMPONENTS

A. Field instruments will use common transmitters where possible.

B. A16 Turbidity Element and Transmitter:

1. General:
   a. Function: Continuously measure, indicate, and transmit a signal proportional to turbidity of a sample stream of process fluid.
   b. Type: Light scatter detection measurement at an angle of 90 degrees in a 360 degree radius around the axis of the incident light beam.
   c. Parts: Element, transmitter (controller), interconnecting cable, mounting hardware, accessories, and expendables.
2. Performance:
   a. Complies with US EPA HACH Method 10258.
   b. Range: 0 NTU to 700 NTU.
   c. Lower Limit of Detection: 0.0001 NTU.
   d. Resolution: 0.0001 NTU.

e. Repeatability: Plus or minus 1 percent or plus or minus 0.0006 NTU, whichever is greater.
f. Response Time: Within 30 seconds.
g. Required Flow: 100 mL to 1000 mL per minute.
h. Sample Temperature: 35 degrees F to 140 degrees F.
i. Sample Pressure:
    1) 87 psig at temperature range of 35 degrees F to 104 degrees F.
    2) 43 psig at temperature range of 104 degrees F to 140 degrees F.
j. Operating Temperature: 32 degrees F to 122 degrees F.
k. Operating Humidity: 5 percent to 95 percent, noncondensing.
l. Accuracy:
    1) From 0 NTU to 40 NTU: Plus or minus 2 percent of reading or plus or minus 0.01 NTU, whichever is greater.
    2) From 40 NTU to 1000 NTU: Plus or minus 10 percent of reading.

3. Element:
    a. The low range online laser turbidimeter consists of a Class 1 650 nm (EPA) laser light source and 360 degrees by 90 degrees detection system with predictive diagnostics, automatic cleaning, and flow measurement designed to continuously monitor turbidity in a sample stream.
    b. Dimensions: 10 inches by 10.5 inches by 7.5 inches, nominal.
    c. Fittings:
        1) Sample Quick Connector: 1/4-inch for 1/4-inch tubing.
4. Cabling: As required.
5. Expendables:
    a. Calibration Kits:
        1) Stablcal Verification Standards:
            a) 1 liter of 20 NTU calibration standard.
            b) 1 liter of 1 NTU verification standard.
            c) Quantity: One each for each turbidimeter.
            d) Two Stablcal calibration cylinders, minimum.
        2) Formazin Calibration Standard:
            a) Kit including 0.5 liter of 4000 NTU Formazin, pipet, and calibration cylinder.
            b) Quantity: One for each turbidimeter.
        3) Desiccant cartridge.
        4) Order expendables just before startup.
6. Accessories:
    a. Glass calibration/verification rod.
    b. Flow sensor.
    c. Automatic cleaning module.
    d. Bubble trap.

e. Turbidimeter maintenance kit.

7. Manufacturer and Product:
   a. Hach Company; Model TU5400sc Ultra-High Precision Laser Turbidimeter with SC200 controller (see below).
   b. No substitutions allowed.

C. A119D Suspended Solids Analyzer:

1. General:
   a. Function: Measure, indicate and transmit turbidity and suspended solids in either water or wastewater.
   b. Type:
      1) Insertion into pressurized pipe.
      2) Dual infrared scattered light photometer.
2. Performance:
   a. Measurement Range:
      1) Turbidity: 0.001 NTU/FNU to 4,000 NTU/FNU.
      2) Suspended Solids: 0.001 gL to 50 g/L.
   b. Response Time: Less than 1 second, adjustable.
3. Service:
   a. Insertion into pressurized pipe, water or wastewater.
   b. Operating Temperature:
      1) Probe: 32 degrees F to 104 degrees F.
      2) Transmitter: Minus 4 degrees F to 140 degrees F.
4. Element:
   a. Probe:
      1) Stainless steel housing.
      2) Back-scatter photo receptor to detect light at 90 degrees and 135 degrees to 140 degrees to the transmitted light beam; to measure suspended solids in heavily located sample streams.
      3) Cleaning system, self-cleaning wiper or air connection.
5. Cable Length: As required.
6. Miscellaneous:
   a. Service Interval: 12 months.
   b. Calibration: Sample specific, based on gravimetric TS analysis.
7. Accessories (for each unit provided):
   a. A retractable insertion mounting kit as required for removal without isolating the process (Hach Model #5738400).
   b. Provide with cleaning system for the probe.
   c. Replacement wiper blades, if applicable, four packages of five per unit supplied.
8. Manufacturer and Product: Hach Company; SOLITAX ts-line sc sensor with SC200 controller.

D. A150 Analytical Indicating Transmitter, Two-Channel:

1. General:
   a. Function: Connect to two analytical probes and indicate analytical probe data.
2. Transmitter:
   a. Display:
      1) Display: Graphic LCD, with LED backlighting/ transreflective.
         a) Display primary readout of probe data in engineering units.
      2) Auxiliary Readout: Display ancillary probe information.
   b. Ambient Conditions:
      1) Temperature minus 20 degrees C to 60 degrees C (minus 4 degrees F to 140 degrees F).
      2) Humidity: 0 percent to 95 percent, relative, noncondensing.
   c. Signal Interface:
      1) Analog Output: Two isolated 4 mA to 20 mA dc for load impedance up to 500 ohms.
      2) Relay Outputs: Four electromechanical SPDT (Form C) contacts, 0.5A, 230V ac.
      3) Digital Communication: Modbus RTU/RS-485 and/or HART per channel.
   d. Enclosure: NEMA 4X/IP66 polycarbonate/aluminum.
   e. Mounting Hardware: Type 316 stainless steel hardware suitable to support panel to equipment rack.
   f. Provide a Type 316 stainless steel sun shield (painted white) for transmitter display.
   g. Power Requirements: 110V ac to 240V ac plus or minus 10 percent, 50/60-Hz.
   h. Stainless steel equipment tag.
3. Manufacturer and Product: Hach; Dual channel SC200 controller.

2.04 FLOW COMPONENTS

A. F4 Flow Element and Transmitter, Electromagnetic:

1. General:
   a. Function: Measure, indicate, and transmit the flow of a conductive process liquid in a full pipe.
   b. Type:
      1) Electromagnetic flowmeter, with operation based on Faraday’s Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.
      2) Full bore meter with magnetic field traversing entire flow-tube cross section.

3) Unacceptable are insert magmeters or multiple single point probes inserted into a spool piece.

c. Parts: Flow element, transmitter, interconnecting cables, and mounting hardware. Other parts as recommended by manufacturer.

2. Service:
   a. Stream Fluid:
      1) Wastewater.
      2) Suitable for liquids with a minimum conductivity of 5 microS/cm and for demineralized water with a minimum conductivity of 20 microS/cm.
   b. Flow Stream Descriptions: If and as described below.
3. Operating Temperature:
   a. Element:
      1) Ambient: Minus 5 degrees F to 140 degrees F, typical.
      2) Process: Minus 5 degrees F to 140 degrees F, typical.
   b. Transmitter:
      1) Ambient: Minus 5 degrees F to 140 degrees F, typical.
      2) Storage: 15 degrees F to 120 degrees F, typical.
4. Performance:
   a. Flow Range: To be determined by Seller.
   b. Accuracy: Plus or minus 0.2 percent of rate for all flows resulting from pipe velocities of 3 feet to 30 feet per second.
   c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.
5. Features:
   a. Zero stability feature to eliminate the need to stop flow to check zero alignment.
   b. No obstructions to flow.
   c. Very low pressure loss.
   d. Measures bi-directional flow.
6. Process Connection:
   a. Meter Size (diameter inches): To be determined by Seller.
   b. Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D; or wafer style depending on meter size.
   c. Flange Material: Carbon steel.
7. Power (Transmitter): 120V ac, 60-Hz.
8. Element:
   a. Meter Tube Material: Type 304 or Type 316 stainless steel.
   b. Liner Material: EPDM or hard rubber.
   c. Liner Protectors: Covers (or grounding rings) on each end to protect liner during shipment.
   d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.

e. Electrode Material: Type 316 stainless steel or Hastelloy C.
f. Grounding Ring:
    1) Quantity: Two.
    2) Material: Type 316 stainless steel.
g. Enclosure: NEMA 4X, minimum.
h. Submergence: Continuous (up to 10 feet depth), NEMA 6P/IP68.
i. Direct Buried (3 feet to 10 feet): As required.
j. Hazardous Area Certification: Class 1, Division 2, Groups A, B, C, D.

9. Transmitter:
    a. Mounting: Integral to meter.
    b. Display: Required.
        1) Digital LCD display, indicating flow rate and total.
        2) Bi-directional Flow Display: Required.
            a) Forward and reverse flow rate.
            b) Forward, reverse and net totalization.
    c. Parameter Adjustments: By keypad or nonintrusive means.
    d. Enclosure: NEMA 4X, minimum.
    e. Empty Pipe Detection: Drives display and outputs to zero when empty pipe detected.
10. Signal Interface (at Transmitter):
    a. Analog Output:
        1) Isolated 4 mA to 20 mA dc for load impedance from 0 ohm to at least 500 ohms minimum for 24V dc supply.
        2) Supports Superimposed Digital HART protocol.
    b. Discrete Outputs.
        1) Two discrete outputs, typical, rated for up to 30 volts, typical.
        2) Programmable for the Following Typical Parameters, at minimum: Totalizer pulse, high/low flow rates, percent of range, empty pipe zero, fault conditions, forward/reverse, etc.
11. Cables:
    a. Types: As recommended by manufacturer.
    b. Lengths: As required to accommodate device locations plus 100 feet.
12. Built-in Diagnostic System:
    a. Features:
        1) Field programmable electronics.
        2) Self-diagnostics with integral troubleshooting guide.
        3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
        4) Initial flow tube calibration and subsequent calibration parameter checks.

13. Factory Calibration:
    a. Calibrated in an ISO 9001 and NIST certified factory.
    b. Factory flow calibration system must be certified by volume or weight certified calibration devices.
    c. Factory flow calibration system shall be able to maintain calibration flow rate for at least 5 minutes for repeatability point checks.
14. Accessories:
    a. Insitu Verification System:
        1) Integral to flow indicating transmitter electronics.
        2) Verifies quantitatively that the meter and signal converter's present condition is the same as originally manufactured.
        3) Physical access to the flow-tube not required.
        4) Meet standards established by the National Testing Laboratory.
        5) Tests and stores the parameters of the last eight verification tests. Verification test includes testing of all operational and output parameters related to primary coils, electrodes, interconnecting cable and signal converter.
        6) Verification standard shall be plus or minus 1 percent of wet calibration for meters produced using the calibration verification service, or plus or minus 2 percent for standard meters.
        7) Web server based integral to the Flow Indicating Transmitter electronics.
15. Warranty: Provide 10-year full factory warranty for each meter and all accessories provide under this specification.
16. Manufacturers and Products:
    a. Endress + Hauser, Inc.; Flow Measuring System with Promag 400 Flow Indicating Transmitter (remote wall-mounted):
        1) Promag 400H (size: 1/12 to 4 inches).
        2) Promag 400W (size: 1 to 78 inches).
    b. Siemens; MAG 3100 Flow Tube with MAG 6000 Flow Indicating Transmitter (remote wall-mounted).
    c. Toshiba; (includes Model LF620 Transmitter – where the transmitter is integral and LF622 Transmitter – where the transmitter is mounted remotely):
        1) Model LF430 (size: 1/2 inch to 16 inches).
        2) Model LF150 (size: 20 inches to 120 inches).

B. F16 Flow Element, Rotameter:

1. General:
    a. Function: Indicate flow rate for process streams and sample streams.
    b. Type: Variable area; float and tapered tube.

2. Service Conditions:
    a. Process Fluid: Water and Wastewater.
    b. Temperature Range:
        1) Process Fluid: 33 degrees F to 250 degrees F.
        2) Ambient: 32 degrees F to 125 degrees F.
    c. Maximum Operating Pressure: To be determined by Seller.
3. Performance:
    a. Flowrate Range: To be determined by Seller.
    b. Accuracy: Plus or minus 2 percent of maximum flow, uncalibrated, over 12.5:1 turndown.
    c. Repeatability: 0.5 percent of full scale.
4. Features:
    a. Nominal Length: 10 inches.
    b. Float Material: Type 316 stainless steel.
    c. Tube: Borosilicate glass.
    d. Seal:
        1) Type: O-ring.
        2) Material: Buna-N.
    e. Polycarbonate operator protection shield.
    f. Mounting: To be determined by Seller.
    g. Scales: Direct-reading external metal scale.
    h. Pressure Drop Design: To be determined by Seller.
5. Size and Process Connections:
    a. Connection Size: To be determined by Seller.
    b. Tube Size: To be determined by Seller.
    c. Connection Material: Type 316 stainless steel.
    d. Connection Type: Threaded NPT.
    e. Connection Orientation: Vertical.
6. Signal Interface: None required.
7. Manufacturers and Products:
    a. ABB; Series 10A4500.
    b. Emerson Process Management Brooks; Series 1100.

C. F23 Flow Element and Switch, Thermal:

1. General:
    a. Function: Monitor process fluid flow and provide contact closure at set point.
    b. Type: Thermal dispersion flow switch using a heated active RTD and a reference RTD temperature sensor to detect rate of flow as a function of temperature difference between the two sensors.
2. Service:
    a. Process Fluid: Water and wastewater.
    b. Process Pressure: To be determined by Seller.
    c. Process Temperature: To be determined by Seller.

3. Performance:
    a. Set Point: To be determined by Seller.
    b. Accuracy: Plus or minus 5.0 percent of reading.
    c. Repeatability: Plus or minus 1 percent of reading, at constant temperature and pressure.
    d. Temperature, Operating:
        1) Sensor Element: Minus 10 degrees C to 80 degrees C.
4. Features:
    a. Wetted Surfaces Materials: Type 316 stainless steel.
    b. Temperature Compensation: Via factory calibration.
5. Process Connections:
    a. Type: 3/4-inch MNPT.
    b. Process Pipe Size: To be determined by Seller.
    c. Connection Type: Insertion.
6. Conduit Connection: 1-inch FNPT.
7. Element Insertion Length: 2 inches from tip of probe to process connection.
8. Electronics:
    a. Location: Integral.
    b. Operating Temperature: Minus 40 degrees F to 140 degrees F.
    c. Calibration Circuit: Built in for field adjustment of set point.
9. Signal Interface Contact: Field selectable two SPDT or one DPDT, rated 6 amps at 115V ac, 220V ac or 24V dc. SPDT with separate set points.
10. Enclosure:
    a. Type: NEMA 4X.
11. Ancillaries:
    a. Furnish interconnecting cable if remote electronics specified.
        1) Cable Jacket: PVC, uon.
        2) Cable Length: 10 feet, uon.
12. Power:
    a. Field Selectable: 115V ac plus or minus 15V ac, 230V ac plus or minus 30V ac, 21V dc to 28V dc, 18V ac to 26V ac.
13. Identifying Tag: Stainless steel.
14. Manufacturers and Products:
    a. Endress & Hauser; Model T-Switch.
    b. Fluid Components, Inc.; Model FLT93S.

D. F51 Flow Element and Transmitter, Thermal Mass Flow:

1. General:
    a. Function: Directly measure, indicate, and transmit mass flow of gas in pipe.
    b. Type: Insertion type, thermal dispersion detection probe using platinum resistance temperature detectors (RTD).
    c. Parts: Elements, transmitter, and interconnecting cable.

2. Performance:
    a. Range for Air at 70 Degrees F and 14.7 psia:
        1) Within the following:
            a) 0.25 to 1,600 standard fps.
            b) 0.25 to 200 actual fps.
    b. Calibrated Span: To be determined by Seller.
    c. Accuracy:
        1) Flow: Plus or minus 1 percent of reading plus 0.5 percent full scale.
    d. Repeatability:
        1) Flow: Plus or minus 0.5 percent of reading.
        2) Temperature: Plus or minus 1 degree F.
    e. Temperature, Operating:
        1) Flow Element: Minus 50 degrees F to plus 350 degrees F.
        2) Transmitter Housing: 0 degree F to plus 120 degrees F.
    f. Pressure, Operating, Flow Element: Up to 50 psig.
3. Flow Element:
    a. Features:
        1) Insertion Length: To be determined by Seller or manufacturer's recommendation.
        2) Wetted Surfaces Materials: Type 316 stainless steel.
    b. Process Connection:
        1) Line Size: To be determined by Seller.
        2) Connection Type: Retractable sensor with graphite-packed gland with 1-1/4-inch MNPT.
        3) Connection Material: Type 316 stainless steel.
    c. Sensor Enclosure:
        1) Type: Aluminum, NEMA 4X.
        2) Certifications for Classes 1 and 2, Divisions 1 and 2, Groups B, C, D, E, F, G, and Eexd IIC, if required.
4. Transmitter:
    a. Features: 2-line by 12-character LCD minimum, programmable.
    b. Nonvolatile memory.
    c. Signal Interface:
        1) Outputs:
            a) Analog: Isolated 4 mA to 20 mA dc for maximum 600 ohm load.
            b) Discrete:
                (1) Two independently adjustable 10 amps at 115V ac or 24V dc.
                (2) Configurable as high or low flow or process temperature.
        2) Communication: RS-232 serial port enables remote adjustment and reading of process values and set points.

d. Power:
    1) Selectable: 115V ac, 230V ac, 24V dc.
e. Electrical Connection: 1/2 inch NPT.
f. Transmitter Enclosure:
    1) Type: NEMA 4X.
    2) Mounting: Remote from sensor.
g. Single factory calibration.

5. Cables:
    a. Length: As required.
    b. Cable Jacket: PVC rated for 220 degrees F.
6. Manufacturers and Products:
    a. Endress & Hauser; Model T-Mass 65.
    b. Fluid Components International; Model GF90 or ST98.
    c. Sierra Instruments; Model 640S.

2.05 LEVEL COMPONENTS

A. L5A Level Element and Transmitter, Radar:

1. General:
    a. Function: Continuous, noncontacting level measurement.
    b. Type: Pulse Radar.
2. Service:
    a. Application: Wastewater level.
    b. Operating Temperature Range:
        1) Element: Minus 4 degrees F to plus 203 degrees F.
        2) Transmitter: Minus 4 degrees F to 122 degrees F.
3. Performance:
    a. Range: 1.5 feet to 50 feet.
    b. Accuracy: Plus or minus 0.1 percent of maximum range or 0.1 inch, whichever is greater.
4. Element:
    a. Process Connection: Top mounted.
    b. Antenna Size/Beam Angle: To be determined by Seller or recommended by manufacturer.
    c. Frequency: K-band (approximately 26 GHz).
    d. Integral temperature compensation.
    e. Hazardous Area Certification: Class 1, Division 2, Groups A, B, C, D.
5. Transmitter:
    a. Integral LCD display with bar graph.
    b. Enclosure: NEMA 4X.
    c. Power Supply: 120V ac.
    d. Electrical Connection: 1/2 inch NPT.

e. Isolated Analog Output:
1) One Minimum: 4 mA to 20 mA dc for load impedance of 0 ohm to 600 ohms.
f. Digital Communication: HART.
g. Discrete Outputs: N/A.

6. Accessories:
a. Handheld HART Programmer: One per lot of units furnished.

7. Manufacturers and Products:
a. Endress+Hauser; Micropilot FMR51.
b. Vega; Vegapuls 66.
c. Rosemount; 5400.

B. L18 Level Switch, Nonmercury:

1. General:
a. Function: Actuate contact at preset liquid level.
b. Type:
1) Direct-acting, stainless steel float with enclosed, encapsulated switch and integral cable.
2) Mercury-free.

2. Service (Liquid): Wastewater.

3. Performance:
a. Setpoint: To be determined by Seller.
b. Differential: 8 inches maximum.
c. Temperature: 32 degrees F (nonfreezing) to 160 degrees F.

4. Features:
a. Entire Assembly: Watertight and impact-resistant.
b. Float:
1) Material and Size: 5.5-inch diameter polymer-coated, Type 316 stainless steel float.
2) Buoyancy: 2 pounds.
c. Cable:
1) Length as necessary per mounting requirements.
2) Plastic-jacketed cable, oil-resistant, and suitable for continuous service.
d. Mounting:
1) Pipe Mounting:
a) Cable clamp, suitable for connection to 1-inch pipe.
b) Pipe-to-wall bracket, suitable for connection to 1-inch pipe.
2) Anchor Mounting Kit:
a) 15-pound vinyl-coated cast-iron anchor.
b) 1/8-inch, Type 316 stainless steel wire rope.
c) Stainless steel cable clips.

5. Signal Interface:
    a. Switch Type: Magnetic reed.
    b. Switch Contacts:
        1) Isolated, rated at least 0.8 amp continuous at 120V ac.
        2) Contact Type: Either NO or NC, as required by application; or SPDT (NO and NC).
6. Accessories: As required.
7. Manufacturers and Products:
    a. Siemens Water Technologies; Model 9G-EF Direct Acting Float Switch (B100).
    b. Contegra; Model FS90.

2.06 PRESSURE COMPONENTS

A. P2 Pressure Differential Switch:

1. General:
    a. Function: Monitor differential pressure.
    b. Type: Diaphragm actuated switch.
2. Performance:
    a. Set Point:
        1) To be determined by Seller.
        2) Repeatability: Plus or minus 1 percent.
    b. Range: Set point shall fall between 20 percent and 90 percent of range.
    c. Static Pressure:
        1) Operating Static Pressure: To be determined by Seller.
        2) Operating static pressure must be less than switch’s rated maximum static pressure.
    d. Overpressure Proof Pressure: At least 400 percent of rated maximum static pressure.
    e. Operating Temperature Range:
        1) Dependent on actuator seal materials.
        2) Buna-N Seal: 0 degree F to 150 degrees F.
3. Features:
    a. Actuator Seal: Buna-N.
    b. Fixed differential.
    c. Mounting: Surface.
4. Process Connection:
    a. 1/4-inch NPT female connections.
    b. Material: Nickel-plated brass.
5. Enclosure: NEMA 4X.
6. Signal Interface:
    a. Contact Type:
        1) SPDT.
        2) Rated for 10 amps minimum at 120V ac.

b. Hermetically Sealed Switch: If recommended by manufacturer.

7. Manufacturer and Product:
   a. Ashcroft; Type 400, D Series.
   b. “Or-equal."

B. P4A Pressure Gauge, Small Dial:

1. General:
   a. Function: Pressure indication.
   b. Type: Bourdon tube.
2. Performance:
   a. Scale Range: To be determined by Seller.
   b. Accuracy: Plus or minus 1 percent of full scale.
3. Features:
   a. Liquid filled.
   b. Dial: 2-1/2-inch diameter.
   c. Pointer Vibration Reduction: Required. Use the following method.
      1) Liquid Filled Gauge Front: Glycerin fill.
   d. Case Material: Stainless steel.
   e. Element Material: Type 316 stainless steel.
   f. Pointer: Aluminum.
   g. Movement: Stainless steel, nylon coated bearings, rotary geared.
   h. Window: Polycarbonate.
   i. Socket Materials: Stainless steel.
4. Process Connection:
   a. Mounting: Lower stem.
   b. Size: 1/4-inch.
   c. Connection Type: Threaded (NPT).
5. Manufacturer and Product:
   a. Ashcroft; Model 1009.
   b. “Or equal.”

C. P6 Pressure Seal, Diaphragm:

1. General:
   a. Function: Isolate sensing element from process fluid.
   b. Type:
      1) Diaphragm.
      2) Fluid filled between diaphragm and sensing element.
2. Service:
   a. Pressure: Same as associated sensor.
   b. Temperature Range: To be determined by Seller.
3. Performance:
   a. Pressure:
      1) For threaded process connections, at least 2,500 psig at 100 degrees F.

2) Glycerin Fill: Suitable only for pressure (not vacuum applications).

b. Temperature:

1) Dependent upon fill fluid.

a) Glycerin (food grade): 0 degree F to 400 degrees F.

b) Silicone: Minus 40 degrees F to plus 600 degrees F.

c) Silicone (food grade): 0 degree F to 375 degrees F.

d) Halocarbon: Minus 70 degrees F to 300 degrees F.

4. Features:

a. Materials:

1) Lower Housing: Type 316 stainless steel.

2) Diaphragm Material: Type 316 stainless steel.

3) Top Housing: Steel.

b. Diaphragm: Welded to upper housing.

c. Filling screw in upper housing.

d. Fill Fluid:

1) As recommended by manufacturer.

2) Factory assembled and filled.

e. Flushing Connection: 1/4-inch NPT in lower housing.

f. Diaphragm Seal Displacement: 0.1 cubic inch, nominal.

5. Connections:

a. Instrument: 1/2-inch female NPT.

b. Process: 1/2-inch female NPT.

6. Manufacturer and Product:

a. Ashcroft; Type 201.

b. “Or-equal.”

D. P7 Pressure Switch, Adjustable Dead Band:

1. General:

a. Function: Monitor pressure, activate switch at set point, and deactivate switch at reset point.

b. Type:

1) Piston-actuated.

2) Both set point and deadband (the differential between set point and reset point) adjustable.

2. Performance:

a. Set Point:

1) To be determined by Seller.

2) Repeatability: Plus or minus 1 percent of range.

b. Reset Point: To be determined by Seller.

c. Range: The set point shall fall between 20 percent and 80 percent of the range.

d. Deadband: Adjustable within nominally 25 percent and 85 percent of range.

e. Overpressure Proof Pressure:
   1) Pressure psi Ranges: At least 400 percent of rated maximum static pressure.
   2) Pressure Inches of Water Ranges: 20 psig.
   3) Compound Range: 250 psig.
   4) Vacuum Range: 250 psig.
f. Operating Temperature Range:
   1) Dependent on actuator seal materials.
   2) For Buna-N seal, 0 degree F to 150 degrees F.

3. Features:
   a. Actuator Seal: Buna-N.
   b. Adjustable deadband.
   c. Mounting: Surface.
4. Process Connection:
   a. 1/4-inch NPT female connections.
   b. Materials:
      1) Pressure psi Ranges: Type 316 stainless steel.
      2) Pressure Inches of Water Ranges: Epoxy coated carbon steel.
5. Enclosure: NEMA 4X.
6. Signal Interface:
   a. Contact Type:
      1) SPDT.
      2) Rated for 10 amps minimum at 120V ac.
   b. Hermetically Sealed Switch: If recommended by manufacturer.
7. Manufacturer and Product: Ashcroft; L or P Series.

E. P9 Pressure Transmitter:

1. General:
   a. Function: Measure pressure and transmit signal proportional to pressure.
   b. Type:
      1) Electronic variable capacitance or silicon strain gauge.
      2) Two-wire transmitter; “smart electronics”.
   c. Parts: Transmitter and accessories.
2. Performance:
   a. Range: To be determined by Seller.
      1) Select transmitter’s factory upper range limit (URL) such that upper boundary of range is as close as possible to 80 percent of factory URL, but does not exceed it.
   b. Accuracy: Plus or minus 0.075 percent of span.
   c. Ambient Operating Temperature: Minus 40 degrees F to plus 175 degrees F, with integral meter.
   d. Process Operating Temperature: 0 degree F to plus 250 degrees F.
   e. Humidity: 0 percent to 100 percent relative humidity.

f. Hazardous Location Certifications: If applicable.

3. Features:
   a. Type: Gauge pressure.
   b. Adjustable damping.
   c. LCD Indicator: Display in either percent or engineering units, field configurable.
   d. Wetted Metallic Parts: Type 316 stainless steel.
      1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.
   e. Wetted O-Rings: Glass filled TFE, graphite filled PTFE, or Viton.
   f. Bolts and Nuts (if required): Type 316 stainless steel.
   g. Fill Fluid: Silicone.
4. Process Connections:
   a. Line Size: 1/2 inch.
   b. Connection Type: FNPT.
   c. Direct/remote Diaphragm Seal: To be determined by Seller or as recommended by manufacturer.
5. Signal Interface:
   a. 4 mA to 20 mA dc output with digital signal based on HART protocol.
      1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.
6. Enclosure:
   a. Type: NEMA 4X.
   b. Materials: Coated aluminum.
   c. Mounting Bracket:
      1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.
7. Accessories: Two-valve (isolate and vent) stainless steel manifold.
8. Manufacturers and Products:
   a. Endress & Hauser; Model Cerabar S PMP71.
   b. Rosemount; Model 3051S.

F. P15 Pressure Seal, Annular:

1. General:
   a. Function:
      1) Sense pressure in a process line and transfer to pressure monitoring device.
      2) Protect attached pressure monitoring device from sludge or slurry.
   b. Type: Annular fluid-filled device that senses pressure through flexible sleeve around full pipe circumference.
2. Performance:
   a. Operating Conditions: Suitable for line pressures up to pipe flange rating.

3. Features:
    a. Construction:
        1) Offline: Threaded.
    b. Materials:
        1) Body: Carbon steel.
        2) Flexible Sleeve: Buna N.
        3) Fill Fluid: Ethylene glycol/water or propylene glycol.
    c. Factory Filled System:
        1) Filled and assembled with pressure monitoring device(s).
        2) Coordinate attached pressure monitoring device(s) with system integrator. Seal vendor's standard pressure monitoring device(s) only acceptable if it meets specification of the related pressure monitoring device.
4. Process Connections:
    a. Mounting: Offline with flush-out or clean-out
        1) Not to be used on suction side of pumps.
    b. Pipe Size:
        1) Offline: 2 inches.
5. Connections:
    a. Offline: Female NPT threaded.
6. Manufacturers and Products:
    a. Red Valve Company; Series 42/742.
    b. Dover/OPW Engineered Systems; Iso-Ring.

2.07 TEMPERATURE COMPONENTS

A. T3 Temperature Element and Transmitter, Resistance:

1. General:
    a. Function: Measure the temperature of a process fluid, and transmit analog signal proportional to temperature.
    b. Type: RTD.
    c. Parts: Element, thermowell, and transmitter. Provide parts from the same manufacturer.
2. Service:
    a. Process Fluid: To be determined by Seller.
    b. Process Temperature Range: To be determined by Seller.
3. Element:
    a. Type:
        1) Single-element.
        2) Three-wire, RTD.
        3) Platinum, 100 ohm nominal at 0 degree C.
    b. Performance:
        1) Accuracy: Greater of plus or minus 4 degrees F or plus or minus 0.75 percent of reading.

c. Features:
   1) Dimensions: 1/4-inch diameter.
   2) Length to accommodate thermowell insertion and extension lengths.
   3) Spring-loaded element when well is used.
   4) Sheath:
      a) Type 316 stainless steel.
      b) Process Operating Temperature Range: Minus 320 degrees F to 900 degrees F.
   5) Terminal Connection Head:
      a) General purpose, NEMA 4 weatherproof.
      b) Maximum Temperature: 220 degrees F.
   6) Thermowell Connection: Union Coupler.
   7) Sensitive Length: 1.6 inch minimum, measured from closed end.

4. Thermowell:
   a. Features:
      1) Inside Diameter: Sized to match thermocouple.
      2) Material: Type 304 stainless steel.
      3) Insertion Length: As recommended by manufacturer.
      4) Extension Length: 3 inches.
   b. Process Connection: 1-inch NPT connection.
   c. Well Type: Plain, threaded solid.
5. Transmitter:
   a. Ambient Operation Conditions:
      1) Temperature: Minus 20 degrees F to 150 degrees F, with display.
      2) Relative Humidity: 0 percent to 100 percent, noncondensing.
   b. Type: Two-wire, powered by a remote power supply.
   c. Performance:
      1) Accuracy: Greater of plus or minus 0.7 degree F or plus or minus 0.06 percent of span.
      2) Response Time: 1.2 second 90 percent response time for 80 percent input step, with minimum damping.
   d. Electrical Safety: Standard.
   e. Features:
      1) Indicator: Three line LCD.
      2) Automatic reference junction compensation.
      3) Failsafe Mode:
         a) User configurable ON.
         b) Downscale.
      4) Electric Damping: 1.2 seconds.
   f. Signal Interface: 4 mA to 20 mA dc.
   g. Power: 24V dc external power supply.

h. Enclosure:
   1) Materials: Epoxy coated, low-copper aluminum.
   2) Type: NEMA 4X.
   3) Mounting: Wall, pipe stand, or integral to thermowell.
      a) For wall or pipe stand, provide stainless steel mounting set.
      b) For integral thermowell mount, provide zinc-plated steel union coupling.

6. Manufacturers and Products:
   a. Endress & Hauser; Series TMT142 transmitter.
   b. Rosemount; Series LTS Thermowell, 78 Series Platinum RTD and Model 3144P Transmitter.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 40 99 90
PACKAGE CONTROL SYSTEMS

PART 1 GENERAL

1.01 WORK OF THIS SECTION

A. Related Sections: This Section augments and provides supplemental information to Sections including, but not limited to:

1. Section 01 30 00, Administrative Requirements.
2. Section 40 91 00, Instrumentation and Control Components.
3. Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

B. Major Work Items Include: Engineering, furnishing, supervising installation, calibrating, adjusting, testing, documenting, and starting up, training for a complete package control system. The package control system described in the related equipment specification sections defines the overall control and monitoring requirements of the system.

1. Major parts are:
   a. Instrumentation including primary elements, transmitters, control devices, and control panels, as specified in Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), and as specified in Section 40 91 00, Instrumentation and Control Components.
   b. Programmable logic controllers (PLCs).
   c. Operator Interface Unit (OIU).
   d. Standard and application software.
   e. Control panel hardware.
   f. Assemble and test control panels and panel components for proper operation prior to shipment from vendor’s factory.
   g. Software Integration Assistance: Provide assistance to Process Control System (PCS) Integrator in testing and implementing interfaces and communications between the package control system provided under this Contract and the WRRF Plant PCS.
   h. PCS and SCADA are used interchangeably in this section.

C. Primary functions of the control system include:

1. Process control.
2. Data acquisition.
3. Text and graphical displays.
4. Alarming, and report generations.

5. The ability to shut down the system to a safe and stable condition in the event of emergency shutdown conditions.
6. The ability to restart the system after a power failure.
7. The ability to start and stop trains when required.

D. Data Integration with PCS/SCADA:

1. The Membrane Package Control Subsystem (MPCS) is required to interface with and be integrated with the WRRF Plant PCS/SCADA. The System Supplier shall assist with coordination and integration of the MPCS into plant control by providing:
    a. PCS/SCADA application shall directly monitor and/or write to MPCS PLC tags that align with the same PLC tags monitored and/or written to from the MPCS OIT. All monitoring, alarm, and control functions available from the MPCS shall be duplicated at SCADA by PCS system integrator.
    b. Logistical and technical support for parallel monitoring and control of the membrane package system by the MPCS and the PCS, including but not limited to:
        1) Coordination between plant and membrane package P&IDs.
        2) Defining data maps to be exchanged between the MPCS and PCS.
        3) Defining communication requirements and programming procedures to accomplish the data exchange and parallel control by the MPCS and PCS.
        4) Export files of MPCS PLC logic, tag-names and I/O configurations for incorporation into PCS/SCADA.
        5) Graphic display (“screen shots”) files and functional descriptions of graphic elements.
        6) Testing and startup assistance.
    c. Scheduling and facilitating communication of the specific technical data necessary to coordinate and integrate the systems, including:
        1) Workshops to convey and disseminate essential information between the System Supplier, Buyer, Engineer, the membrane control system integrator, and PCS system integrator.
            a) Refer to Section 43 32 56, Membrane Equipment System (Membrane Bioreactor), for specifics on the various workshops.
    d. Designing MPCS application software and hardware to facilitate the transfer of monitoring and control functionality and data between the PCS and MPCS.

E. Detailed Wiring Design: Including wiring schematics (diagrams), loop diagram and interconnecting diagrams designed to completely show control panel wiring, termination's, wire numbers, interfaces with other systems, hardwired functions, interlocks, and wiring of all internal and external components including field instrument and equipment to be provided. Where sample drawings are included in the Proposal documents, submitted drawings shall have the same format.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
   a. A182/A182M, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.
   b. A276, Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.
   c. A312/A312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
   d. B32, Standard Specification for Solder Metal.
   e. B88, Standard Specification for Seamless Copper Water Tube.
3. Deutsche Industrie-Norm (DIN): VDE 0611, Specification for modular terminal blocks for connection of copper conductors up to 1,000V ac and up to 1,200V dc.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): C62.41, Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.
5. The Instrument, Systems, and Automation Society (ISA):
   a. RP12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
   b. RP55.1, Hardware Testing of Digital Process Computers, Recommended Practice.
   c. S5.1, Instrumentation Symbols and Identification (NRC ADOPTED).
   d. S5.4, Instrument Loop Diagrams.
   e. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   f. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
6. International Conference on Energy Conversion and Application (ICECA).
7. National Electric Code (NEC).

8. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    b. ICS 1, General Standards for Industrial Control and Systems.
9. National Fire Code, National Fire Protection Association (NFPA): 820, Fire Protection in Wastewater Treatment Plants.
10. UL:
    a. 508, Standards for Safety, Industrial Control Equipment.
    b. 508A, Standards for Safety, Industrial Control Panels.

1.03 DEFINITIONS

A. Abbreviations:

1. FAT: Factory Acceptance Test.
2. I&C: Instrumentation and Control.
3. I/O: Input and Output.
4. HMI: Human/Machine Interface.
5. MCC: Motor Control Center.
6. MPCS: Membrane Package Control Subsystem.
7. O&M: Operation and Maintenance.
8. PC: Personal computer.
9. P&ID: Process and Instrument Diagram.
10. PCB: Printed circuit board.
11. PCS: Plant Control System.
12. PID: Proportional, Integral, Derivative.
13. PLC: Programmable Logic Controller.
14. RIO: Remote Input/Output.
15. OIU: Operator Interface Unit (normally flat panel LCD, panel mounted).
16. SAT: Site Acceptance Test.
17. SCADA: Supervisory Control and Data Acquisition.
18. TCP/IP: Transmission Control Protocol/Internet Protocol.
19. VFD: Variable Frequency Drive.

B. Enclosure: Control panel, console, cabinet, or instrument housing.

C. Instructor Day: 8 hours of actual instruction time.

D. Intelligent Motor Control: Use of digital networks and network devices, such as Ethernet networks and devices, to provide control and monitoring from PCS to motor starters or Variable Frequency Drives (VFDs).

E. Software:

1. Programming of digital devices using a programming language.
2. Configuring of digital devices using all types of configuring process.
3. Programs or configuration data stored in read only memory, programmable read only memory, read/write memory, disk, tape, or other storage device.

F. Standard Software: Development Software packages that are independent of works on which they are used. Standard software includes system software and process monitoring and control software.

1. System Software: Development software by digital equipment manufacturers and software companies. Includes, but is not limited to, operating systems; programming languages such as C, BASIC, Visual BASIC.
2. OIU Software: Configuration software packages independent of specific process control work on which they are used. Includes, but is not limited to, providing capability for data acquisition, monitoring, alarming, operator interface, data collection, data retrieval, trending, control, and diagnostics.
3. PLC Programming Software.

G. Application Software:

1. Software to provide functions unique to this Work and that are not provided by standard software alone.
2. Configuring databases, tables, displays, reports, parameter lists, ladder logic, block diagram logic, and control strategies required to implement functions unique to the Work.

H. System Supplier: The supplier of the equipment package system.

I. Membrane Control System Integrator: The System Supplier shall engage a qualified Control System Integrator to assist in coordinating the implementation of instrumentation and control systems provided for the equipment system.

J. Membrane Control System Integrator's Work Scope: Use Membrane Control System Integrator for at least the following work:

1. For Control System Equipment and Ancillaries:
   a. Coordinate completing detail design.
   b. Coordinate required Submittals.
   c. Coordinate supply of equipment and ancillaries selection.

d. Coordinate supply of instructions, details, and recommendations to, and coordination with, System Supplier for Certificate of Proper Installation.
e. Verify readiness for operation.
f. Verify the correctness of final power and signal connections (lugging and connecting).
g. Coordinate adjusting and calibrating.
h. Coordinate commissioning.
i. Testing and coordination of testing.
j. Coordinate training.

2. Verify the following Work not by the Membrane Control Systems Integrator is provided:
   a. Correct type, size, and number of signal wires with their raceways.
   b. Correct electrical power circuits and raceways.
   c. Correct size, type, and number of control system related pipes, valves, fittings, and tubes.
   d. Correct size, type, materials, and connections of process mechanical piping for in-line primary elements.

K. Rising/Falling: Define action of discrete devices about their set point.

1. Rising: Contacts close when an increasing process variable rises through set point.
2. Falling: Contacts close when a decreasing process variable falls through set point.

L. Signal Types:

1. Analog Signal - Current Type:
   a. 4 mA to 20 mA dc signals conforming to ISA S50.1.
   b. Unless otherwise indicated for specific Subsystem components, use the following ISA S50.1 options.
      1) Transmitter Type: Number 2, two-wire.
      2) Transmitter Load Resistance Capacity: Class L.
      3) Fully isolated transmitters and receivers.
   c. Voltage Type: 1V dc to 5V dc within panel where common high precision dropping resistor is used.
2. Discrete signals, two-state logic signals using 24V dc sources within a panel, and dry contacts for interface to equipment outside a panel, or as indicated.
3. Pulse Frequency Signals:
   a. Direct current pulses whose repetition rate is linearly proportional to process variable.
   b. Pulses generated by contact closures or solid state switches.
   c. Power source less than 30V dc.

4. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.

1.04 SUBMITTALS

A. Action Submittals:

1. Bill of material, catalog information, descriptive literature, wiring diagrams, and Shop Drawings for components of control system.
2. Catalog information on electrical devices furnished with system.
3. Shop Drawings, catalog material, and dimensional layout drawings for control panels and enclosures.
4. Panel elementary diagrams of prewired panels. Include in diagrams control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.
5. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures. Where sample drawings are included in the Proposal documents, submitted Drawings shall have the same format. These shall include the following, as a minimum:
    a. Submit membrane package P&IDs.
    b. Submit data sheets and catalog cuts of MPCS panel components.
    c. Submit MPCS Panel Drawings: Ethernet network diagrams, control diagrams, wiring diagrams, loop drawings and panel elevations.
    d. Submit process control narratives.
    e. Submit electronic copies of fully documented application software (PLC and OIU).
    f. Submit factory acceptance test procedures.
    g. Submit network configuration, including electronic network switch configuration.
    h. Submit site acceptance test procedures, including:
        1) Functional Test forms.
        2) Performance Test forms.
6. Submit data maps for interface with the PCS.
7. Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.
8. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces. Coordinate with Construction Contractor for external interface termination details.
9. Equipment weight, center of gravity, anchor bolt layout, anchor bolt spacing, and other pertinent information required to anchor the equipment.

B. Informational Submittals:

1. Operation and Maintenance Data as specified in Section 01 30 00, Administrative Requirements.
2. Programmable Controller (PLC) Submittals: Complete set of user manuals.
3. Manufacturer's list of proposed spares, expendables, and test equipment.
4. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Membrane Control System Integrator: Minimum of 10 years' experience providing, integrating, installing, and commissioning similar systems as required for this Project.
2. Membrane Control System Integrator's Site Representative: Minimum of 5 years' experience installing systems similar to control systems as required for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers and related equipment as recommended by capsule manufacturer.

B. Refer to Section 01 61 01, Product Requirements.

1.07 SPARE PARTS AND SPECIAL TOOLS

A. In computing spare parts quantities based on specified percentages, round up to nearest whole number.

B. Selector Switch, Pushbutton, and Indicating Light: 20 percent, one minimum, of each type used.

C. Fuse: 100 percent, five minimum, of each type used.

D. PLC CPUs: One.

E. PLC I/O Modules: One of each style.

F. PLC Power Supply: One of each style.

PART 2 PRODUCTS

2.01 GENERAL

A. Refer to Section 40 91 00, Instrumentation and Control Components, for additional component and instrument requirements.

B. Furnish equipment items as required. Furnish all materials, equipment, and software, necessary to affect required system and loop performance.

C. First Named Manufacturer: Package Control System design is based on first named manufacturers of equipment and materials.

1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with Article Submittals.
2. If using proposed item requires other changes, provide work and equipment to implement these changes. Changes that may be required include, but are not limited to: different installation, wiring, raceway, enclosures, connections, isolators, intrinsically safe barriers, software, and accessories. These shall be provided at no additional cost to the Buyer.
3. If an item (including but not limited to control panels, junction boxes, terminal boxes, conduit, wiring, instruments, operator interface devices, control panel devices, etc.) is used on this Project that deviates from the Specification and Contract Document requirements and has not been Approved for use on this Project in writing by both the Engineer and the Buyer; the item shall be disconnected and removed from the Project Site and replaced with the Specified item at no additional expense to the Buyer and no delay to the approved Project Schedule.
4. If using proposed item, all functionality of the first listed manufacturer's item must be met by the proposed item. This may include, but not be limited to, external components to meet the functional requirements. These shall be provided at no additional cost to the Buyer.

D. Like Equipment Items:

1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.
2. Implement all same or similar functions in same or similar manner. For example, control logic, sequence controls, and display layouts.

2.02 SIGNAL CHARACTERISTICS

A. Analog Signals:

1. 4 mA to 20 mA dc, in accordance with compatibility requirements of ISA S50.1.
2. Unless otherwise specified or shown, use Type 2, two-wire circuits.
3. Transmitters: Load resistance capability conforming to Class L.
4. Fully isolate input and output signals of transmitters and receivers.
5. HART capable digital protocol.

B. Pulse Frequency Signals: dc pulses whose repetition rate is linearly proportional to process variable over 10:1 range. Generate pulses by contact closures or solid-state switches.

1. Power Source: Less than 30V dc.

C. Discrete Signals:

1. Two-state logic signals.
2. Utilize 120V ac sources for control and alarm signals.
3. Alarm signals shall be normally open, close to alarm isolated contacts rated for 5-ampere at 120V ac and 2-ampere at 30V dc.

2.03 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.
2. Hoffmann Engineering; Model A-HCI.

2.04 CONTROL PANEL

A. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), UL 508, state and local codes, and applicable sections of NEMA, ANSI, and ICECA.

B. Minimum Metal Thickness: 14 gauge.

C. Rating:

1. Indoor (Electrical Room):
   a. NEMA 12 Panels: Dust-proof, painted steel.
2. Outdoor:
   a. NEMA 250, Type 4X Panels: Type 316 stainless steel construction unless otherwise specified.

D. Doors:

1. Three-point latching mechanisms in accordance with NEMA 250 Type 1 and 12 panels with doors higher than 18 inches.
2. For other doors, stainless steel quick release clamps.

E. Cutouts shall be cut, punched, or drilled and finished smoothly with rounded edges.

F. Access: Front, suitable for installation with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.

G. Temperature Control:

1. Size panels to adequately dissipate heat generated by equipment mounted on or in the panel.
2. Furnish cooling fans with air filters if required to dissipate heat. Cooling systems must provide cooling without compromising NEMA rating.
3. For panels outdoors or in unheated areas, furnish thermostatically controlled heaters to maintain temperature above 40 degrees F.

H. Push-to-Test Circuitry: For each push-to-test indicating light, provide a fused push-to-test circuit.

I. Lighting: Minimum of one hand switch controlled internal LED light for panels 12 cubic feet and larger. For larger panels, provide a minimum of one internal LED light per door (i.e., two-door panel should have two lights).

J. Minimum of one 120-volt GFCI duplex receptacle for panels 12 cubic feet and larger.

K. Finish:

1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Manufacturer’s standard gray unless otherwise specified.
2. Internal Surfaces: White enamel.

L. Control Panel doors shall open through 180 degrees without restriction.

M. Shelf: Control Panel enclosures shall be supplied with a flip-out shelf for laptop computers where the panel contains a PLC or remote rack. The shelf shall be installed on the inside of the Control Panel enclosure’s door, at 1,100 mm above floor and shall be easily accessible without obstructing the PLC.

N. Panel Manufacturers:

1. Hoffman.
2. SCE.
3. Wiegmann.
4. H.F. Cox.

O. Breather and Drains: Furnish with NEMA 250, Type 4 and Type 4X panels.

1. Manufacturer and Products: Cooper Crouse-Hinds; ECD Type 4X Drain and Breather; Drain Model ECD1-N4D, Breather Model ECD1-N4B.

2.05 CONTROL PANEL ELECTRICAL

A. UL Listing Mark for Enclosures: Mark stating “Listed Enclosed Industrial Control Panel” per UL 508A.

B. I&C and electrical components, terminals, wires, and enclosures UL recognized or UL listed.

C. Control Panels without Motor Starters:

1. Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
2. Locate to provide clear view of and access to breakers when door is open. Group on single subpanel. Provide typed directory.
3. Circuit Breakers:
    a. Coordinate for fault in branch circuit trips, branch breaker, and not main breaker.
    b. Branch Circuit Breakers: 15 amps at 250V ac.
    c. Breaker Manufacturers and Products:
        1) Heinemann Electric Co.; Series AM/S.
        2) Airpax/North American Philips Controls Corp.; Series 209.
4. Power Distribution Blocks: Furnish to parallel feed tap on branch circuit protective devices. Do not “leap frog” power conductors.
5. Terminations for Power Conductors: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

D. Wiring:

1. ac Circuits:
    a. Type: 600-volt, Type MTW stranded copper.
    b. Size: For current to be carried, but not less than 14 AWG.
2. Analog Signal Circuits:
    a. Type: 300-volt, Type 2 stranded copper, twisted shielded pairs.
    b. Size: 18 AWG, minimum.

3. Other dc Circuits.
    a. Type: 600-volt, Type MTW stranded copper.
    b. Size: 18 AWG, minimum.
4. Separate analog and other dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
5. Enclose wiring in sheet metal raceways or plastic wiring ducts.
6. Wire Identification: Numbered and tagged at each termination.
    a. Wire Tags: Machine printed, heat shrink.
    b. Manufacturers:
        1) Brady PermaSleeve.
        2) Tyco Electronics.

E. Wiring Interface:

1. For analog and discrete signal, terminate at numbered terminal blocks.
2. For special signals, terminate power (240 volts or greater) at manufacturer's standard connectors.
3. For panel, terminate at equipment on/with which it is mounted.

F. Terminal Blocks:

1. Quantity:
    a. For external connections.
    b. Wire spare or unused panel mounted elements to their panels' terminal blocks.
    c. Spare Terminals: 20 percent of connected terminals, but not less than 10.
2. General: Group to keep 120V ac circuits separate from 24V dc circuits.
    a. Connection Type: Screw connection clamp.
    b. Compression Clamp:
        1) Hardened steel clamp with transversal grooves penetrating wire strands providing a vibration-proof connection.
        2) Guides strands of wire into terminal.
    c. Screws: Hardened steel, captive, and self-locking.
    d. Current Bar: Copper or treated brass.
    e. Insulation:
        1) Thermoplastic rated for minus 55 degrees C to plus 110 degrees C.
        2) Two funnel shaped inputs to facilitate wire entry.
    f. Mounting:
        1) Standard DIN Rail.
        2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
        3) End Stops: One at each end of rail, minimum.
    g. Wire Preparation: Stripping only.

h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
i. Marking System:
    1) Terminal number shown on both sides of terminal block.
    2) Allow use of preprinted and field marked tags.
    3) Terminal strip numbers shown on end stops.
    4) Mark terminal block and terminal strip numbers as shown on panel control diagrams and loop diagrams.
j. Test Plugs: Soldered connections for 18 AWG wire.
    1) Pin Diameter: 0.079 inch.
    2) Quantity: 10, 20, 40 (need two plugs per test meter).
    3) Manufacturers and Products:
        a) Allen-Bradley; 1492-TP23.
        b) Entrelec; Type FC2.

3. Terminal Block, General Purpose:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 32 amp.
    c. Wire Size: 22 AWG through 10 AWG.
    d. Rated Wire Size: 10 AWG.
    e. Color: Gray body.
    f. Spacing: 0.25 inch, maximum.
    g. Test Sockets: One screw test socket 0.079-inch diameter.
    h. Manufacturers and Products:
        1) Allen-Bradley; 1492-J4.
        2) Entrelec; Type M4/6.
4. Terminal Block, Ground:
    a. Wire Size: 22 AWG through 12 AWG.
    b. Rated Wire Size: 12 AWG.
    c. Color: Green and yellow body.
    d. Spacing: 0.25 inch, maximum.
    e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
    f. Manufacturers and Products:
        1) Allen-Bradley; 1492-JG4.
        2) Entrelec; Type M4/6.P.
5. Terminal Block, Blade Disconnect Switch:
    a. Use: Provide one for each discrete input and output field interface wire.
    b. Rated Voltage: 600V ac.
    c. Rated Current: 10 amp.
    d. Wire Size: 22 AWG through 12 AWG.
    e. Rated Wire Size: 12 AWG.
    f. Color: Gray body, orange switch.
    g. Spacing: 0.25 inch, maximum.
    h. Test Sockets: One screw test socket 0.079 inch diameter.

i. Manufacturers and Products:
   1) Allen-Bradley; 1492-JKD3.
   2) Entrelec; Type M4/6.SN.

6. Terminal Block Diode:
   a. Rated Voltage: 24V dc.
   b. Rated Current: 30 ma.
   c. Wire Size: 16 AWG.
   d. Manufacturer and Product: Phoenix Contact; ST-IN.
7. Terminal Block, Fused, 24V dc:
   a. Rated Voltage: 57V dc.
   b. Rated Current: 6.3 amp.
   c. Wire Size: 22 AWG through 12 AWG.
   d. Rated Wire Size: 12 AWG.
   e. Color: Gray body.
   f. Fuse: 5 mm by 20 mm GMA fuses.
   g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
   h. Indication: LED diode 24V dc.
   i. Leakage Current: 2.0 mA, maximum.
   j. Spacing: 0.32 inch, maximum.
   k. Manufacturers and Products:
      1) Allen-Bradley; 1492-WFB424.
      2) Entrelec; Type M4/8.SFD.
8. Terminal Block, Fused, 120V ac:
   a. Rated Voltage: 264V ac.
   b. Rated Current: 15 amp.
   c. Wire Size: 22 AWG through 12 AWG.
   d. Rated Wire Size: 12 AWG.
   e. Color: Gray body.
   f. Fuse: 5 mm by 20 mm GMA fuses.
   g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
   h. Indication: Neon lamp 110V ac.
   i. Leakage Current: 2.0 mA, maximum.
   j. Spacing: 0.32 inch, maximum.
   k. Manufacturers and Products:
      1) Allen-Bradley; 1492-WFB4250.
      2) Entrelec; Type M4/8.SFL.

G. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.

H. Relays:

1. General:
   a. Relay Mounting: Plug-in type socket.
   b. Relay Enclosure: Provide dust cover.
   c. Socket Type: Screw terminal interface with wiring.
   d. Socket Mounting: Rail.
   e. Furnish holddown clips.
2. Control Circuit Switching Relay, Nonlatching:
   a. Type: Compact general purpose plug-in.
   b. Contact Arrangement: 2 Form C contacts (DPDT).
   c. Contact Rating: 8A at 240V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: To be determined by Seller.
   f. Coil Power: 0.5 watt (dc), 1.2VA (ac).
   g. Expected Mechanical Life: 10,000,000 operations.
   h. Expected Electrical Life at Rated Load: 100,000 operations.
   i. Indication Type: Neon or LED indicator lamp.
   j. Push-to-test button.
   k. Manufacturer and Product: Allen-Bradley; Bulletin 700-HK.
3. Control Circuit Switching Relay, Latching:
   a. Type: Dual coil mechanical latching relay.
   b. Contact Arrangement: 2 Form C contacts (DPDT).
   c. Contact Rating: 10A at 240V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: To be determined by Seller.
   f. Coil Power: 1.2 watts (dc), 1.44VA (ac).
   g. Expected Mechanical Life: 500,000 operations.
   h. Expected Electrical Life at Rated Load: 50,000 operations.
   i. Manufacturer and Product: Allen-Bradley; Bulletin 700-HJ.
4. Control Circuit Switching Relay, Time Delay:
   a. Type: Adjustable time delay relay.
   b. Contact Arrangement: 2 Form C contacts (DPDT).
   c. Contact Rating: 10A at 240V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: To be determined by Seller.
   f. Operating Temperature: Minus 10 degrees C to 55 degrees C.
   g. Repeatability: Plus or minus 2 percent.
   h. Delay Time Range: Select range such that time delay setpoint fall between 20 percent to 80 percent or range.
   i. Time Delay Setpoint: To be determined by Seller.
   j. Mode of Operation: To be determined by Seller.
   k. Adjustment Type: Integral potentiometer with knob external to dust cover.
   l. Manufacturer and Product: Allen-Bradley; Bulletin 700-HT.

I. Power Supplies:

1. Furnish as required to power instruments requiring external dc power, including two-wire transmitters and dc relays. Provide dual power supplies with diode auctioneered outputs.
2. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
3. Provide output over voltage and over current protective devices to:
   a. Protect instruments from damage due to power supply failure.
   b. Protect power supply from damage due to external failure.
4. Enclosures: NEMA 1.
5. Mount such that dissipated heat does not adversely affect other components.
6. Fuses: For each dc supply line to each individual two-wire transmitter.
   a. Type: Indicating.
   b. Mount so fuses can be easily seen and replaced.
7. Manufacturers and Products:
   a. Allen Bradley; 1606-XLS series.
   b. Phoenix Contact; QUINT POWER series.

J. Front-of-Panel Devices in Conjunction with NEMA 250, Type 1 and 12 Panels:

1. Front-of-Panel devices listed below shall be from the same “a” or “b” named vendor, so there is consistency in manufacturer.
2. Potentiometer Units:
   a. Three-terminal, oiltight construction, resolution of 1 percent and linearity of plus or minus 5 percent.
   b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 inch and 1/4 inch.
   c. Include legend plates with service markings.
   d. Manufacturers and Products:
      1) Allen-Bradley; Model 800T.
      2) Eaton/Cutler-Hammer; Model 10250T.
3. Indicating Lights:
   a. Heavy-duty, push-to-test type, oiltight, industrial type with integral transformer for 120V ac applications.
   b. Screwed on prismatic glass lenses in colors noted and factory engraved legend plates for service legend.
   c. Manufacturers and Products:
      1) Eaton/Cutler-Hammer; Type 10250T.
      2) General Electric; CR2940U.

4. Pushbutton, Momentary:
    a. Heavy-duty, oiltight, industrial type with full guard and momentary contacts rated for 10 amperes continuous at 120V ac.
    b. Standard size legend plates with black field and white markings for service legend.
    c. Manufacturers and Products:
        1) Square D; Class 9001, Type K.
        2) Eaton/Cutler-Hammer; Type T.
        3) General Electric; Type CR-2940.
5. Selector Switch:
    a. Heavy-duty, oiltight, industrial type with contacts rated for 120V ac service at 10 amperes continuous.
    b. Standard size, black field, legend plates with white markings, for service legend.
    c. Operators: Black knob type.
    d. Single-hole mounting, accommodating panel thicknesses from 1/16 inch to 1/4 inch.
    e. Manufacturers and Products for Units with up to Four Selection Positions:
        1) Eaton/Cutler-Hammer; Type T.
        2) Square D; Type K.
    f. Manufacturers and Products for Units with up to 12 Selection Positions:
        1) Rundel-Idec; Standard Cam Switch.
        2) Electroswitch; 31.

K. Front-of-Panel Devices Used in Conjunction with NEMA 250, Type 4X Panels:

1. Front-of-Panel devices listed below shall be from the same “a” or “b” named vendor, so there is consistency in manufacturer.
2. Potentiometer, Watertight:
    a. Three-terminal, heavy-duty NEMA 250, Type 4X watertight construction, resolution of 1 percent and linearity of plus or minus 5 percent.
    b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 inch and 1/4 inch.
    c. Include engraved legend plates with service markings.
    d. Manufacturer and Product: Allen-Bradley; Bulletin 800H.
3. Indicating Lights, Watertight:
    a. Heavy-duty, push-to-test type, NEMA 250, Type 4X watertight, industrial type with integral transformer for 120V ac applications and corrosion-resistant service.
    b. Screwed on prismatic lenses and factory engraved legend plates for service legend.

c. Manufacturers and Products:
   1) Square D; Type SK.
   2) Allen-Bradley; Type 800H.

4. Pushbutton, Momentary, Watertight:
   a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with momentary contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.
   b. Standard size, black field, legend plates with white markings for service legend.
   c. Manufacturers and Products:
      1) Square D; Type SK.
      2) Allen-Bradley; Type 800H.
5. Selector Switch, Watertight:
   a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.
   b. Standard size, black field, legend plates with white markings, for service legend.
   c. Operators: Black knob type.
   d. Single-hole mounting, accommodating panel thicknesses from 1/16 inch to 1/4 inch.
   e. Manufacturers and Products:
      1) Square D; Class 9001, Type SK.
      2) Allen-Bradley; Type 800H.

2.06 PROGRAMMABLE LOGIC CONTROLLERS

A. General:

1. Type: Microprocessor-based programmable device with chassis-mounted plug-in modules. Multiple chassis networked together to form distributed programmable controller systems.
2. Parts:
   a. Plug-In Modules: Processor modules, power supply modules, communication modules, and input/output modules.
   b. Chassis.
   c. I/O connection hardware.
   d. Provide components required to make a complete and totally operational system.
3. Provide programming capability for all IEC 61131 programming languages, including Ladder Diagram (LD), Functional Block Diagram (FBD), Structured Text (ST), and Sequential Function Chart (SFC).
4. Minimum of 20 percent spare pre-wired capacity for I/O modules.
5. Minimum of 10 percent spare slots for additional I/O cards.
   a. Provide space in the control panel for additional terminal blocks to support the spare I/O cards.

6. Identification:
    a. Nameplates installed above/below each PLC component (CPU, I/O rack, power supply, etc.).
    b. Identify on I/O modules and terminal blocks the specific I/O points as they have been configured (addressed) in the system, as approved by the Engineer.
    c. Provide typed directory of fuses and breakers on panel door.
7. Manufacturers and Products:
    a. Large Package: Allen-Bradley; ControlLogix L7x series.
    b. Small Package: Allen-Bradley; CompactLogix 5370 L3x series.
    c. No substitutions permitted.

B. Environmental:

1. General: Noncontrolled environment (e.g., variable heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering.
2. Temperature: Continuous operation 0 degree C to 60 degrees C.
3. Humidity: Continuous operation 5 percent to 95 percent noncondensing.

C. Large Package Programmable Logic Controllers (PLCs):

1. General:
    a. Type: Microprocessor-based programmable device with chassis-mounted plug-in modules. Multiple chassis networked together to form distributed programmable controller systems.
    b. Solid state units capable of performing same function as conventional relays, timers, counters, drum sequencers, arithmetic, and other special functions necessary to perform required control functions.
    c. Support up to 500 controller connections.
    d. Minimum of 256 Ethernet/IP connections, 128 TCP connections.
    e. Capable of supporting multiple control networks, including more than one Ethernet network on separate network segment/subnet.
    f. Provide memory sufficient to handle the program objects, including Add-On Instructions.
        1) A limited set of AOIs may be included in the program, as long as minimum control and monitoring functionality of the system is maintained.
        2) Memory size will account for PLC redundancy with 10 percent spare capacity remaining.
        3) Include 2GB nonvolatile memory storage.
    g. Parts:
        1) Plug-In Modules: Processor modules, power supply modules, communication modules, and input/output modules.

2) Chassis.
3) I/O connection hardware.
4) Provide components required to make a complete and totally operational system.

2. Environmental:
   a. General: Noncontrolled environment (e.g., variable heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering.
   b. Temperature: Continuous operation 0 degree C to 60 degrees C.
   c. Humidity: Continuous operation 5 percent to 95 percent noncondensing.
3. Redundancy:
   a. Large package systems shall provide full-redundancy for PLC via fiber optic redundancy module.
      1) Allen-Bradley; ControlLogix 1756-RM2.
4. Communications:
   a. PLC communications will include capability for connection and communication to two separate Ethernet/IP networks:
      1) Plant SCADA network.
      2) Plant I/O network.
   b. Plant SCADA network will use direct connection to a managed switch in the control panel, for communication to SCADA network.
      1) Allen-Bradley; ControlLogix 1756-EN2T.
   c. Plant I/O network will include capability for Device-Level Ring or Device-Level Linear network topologies without addition network switches. This network will include intelligent motor control connections.
      1) Allen-Bradley; ControlLogix 1756-EN2TR.
5. Power Supplies:
   a. Size power supplies for required load(s).
   b. For redundant PLC racks, provide standard power supply:
      1) Allen-Bradley; ControlLogix, 1756-PA75.
   c. For Remote I/O rack(s), provide redundant power supplies:
      1) Allen-Bradley; ControlLogix, 1756-PA75R.
6. Process Input/Output Modules:
   a. Discrete Input, Isolated ac:
      1) Voltage: 120V ac.
      2) Points per Module: 16.
      3) Allen-Bradley; 1756-IA16I.
   b. Discrete Input, Isolated dc (DIDC):
      1) Voltage: 24V dc.
      2) Points per Module: 16.
      3) Allen-Bradley; 1756-IB16I.

c. Discrete Output, Isolated (DO):
   1) Voltage: 24V dc.
   2) Wired to PLC interface relays for dry contact field interface.
   3) Points per Module: 16.
   4) Allen-Bradley; 1756-OW16I.
d. Isolated HART Analog Input (AI):
   1) Signal: 4 mA to 20 mA at 24V dc.
   2) Isolated Analog Input Points per Module: 8.
   3) Allen-Bradley; 1756-IF8IH.
e. Isolated HART Analog Output (AO):
   1) Signal: 4 mA to 20 mA at 24V dc.
   2) Isolated Analog Output Points per Module: 8.
   3) Allen-Bradley; 1756-OF8IH.
f. Terminal Blocks: Provide Allen-Bradley; 1756-TB series. Adjust TB model number corresponding to each input/output module.

D. Small Package Programmable Logic Controllers (PLCs):

1. General:
   a. Type: Microprocessor-based programmable device with bus-style plug-in modules.
   b. Solid state units capable of performing same function as conventional relays, timers, counters, drum sequencers, arithmetic, and other special functions necessary to perform required control functions.
   c. Support up to 256 controller connections.
   d. Minimum of 32 Ethernet/IP connections.
   e. Provide memory sufficient to handle the program objects, including Add-On Instructions.
      1) A limited set of AOIs may be included in the program, as long as minimum control and monitoring functionality of the system is maintained.
      2) Memory size shall account for 10 percent spare capacity remaining.
      3) User memory shall be a minimum of 2 MB.
      4) Include 1 GB nonvolatile memory storage.
   f. Parts:
      1) Plug-In Modules: Processor modules, power supply modules, communication modules, and input/output modules.
      2) Provide components required to make a complete and totally operational system.
2. Environmental:
   a. General: Noncontrolled environment (e.g., variable heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering.

b. Temperature: Continuous operation 0 degree C to 60 degrees C.
c. Humidity: Continuous operation 5 percent to 95 percent noncondensing.

3. Communications: PLC communications will include capability for connection and communication via two built-in Ethernet/IP communication ports.
4. Power Supplies:
   a. Size power supplies for required load(s).
   b. Power supply 120V ac input, 4A at 5V dc, 2A at 24V dc.
      1) Allen-Bradley; CompactLogix,1769-PA4.
5. Process Input/Output Modules:
   a. Discrete Input, AC:
      1) Voltage: 120V ac.
      2) Points per Module: 16.
      3) Allen-Bradley; 1769-IA16.
      4) Provide fused isolation on inputs independent of I/O module.
   b. Discrete Input, DC (DI):
      1) Voltage: 24V dc.
      2) Points per Module: 16.
      3) Allen-Bradley; 1769-IQ16.
      4) Provide fused isolation on inputs independent of I/O module.
   c. Discrete Output, Isolated Relay:
      1) Voltage: 24V dc.
      2) Wired to PLC interface relays for dry contact field interface.
      3) Points per Module: 8.
      4) Allen-Bradley; 1769-OW8I.
   d. HART Analog Input (AI):
      1) Signal: 4 mA to 20 mA at 24V dc.
      2) Analog Input Points per Module: 8.
      3) Spectrum Controls; 1769sc-IF4IH.
      4) Provide fused isolation on inputs independent of I/O module.
   e. HART Analog Output (AO):
      1) Signal: 4 mA to 20 mA at 24V dc.
      2) Analog Output Points per Module: 8.
      3) Spectrum Controls; 1769sc-OF4IH.
      4) Provide fused isolation on inputs independent of I/O module.
   f. Terminal Blocks: Provide Allen-Bradley 1769-TB series. Adjust TB model number corresponding to each input/output module.

2.07 NETWORK COMPONENTS

A. Industrial Ethernet Switch:

1. General:
   a. Function: Modular multiple-port network connection and switch for fiber and copper media.
   b. Type: Managed, store and forward.
   c. Parts: Base unit and switch modules with built-in Ethernet ports.
2. Service:
   a. Operating Temperature: 32 degrees F to 140 degrees F.
   b. Humidity: 10 percent to 95 percent, noncondensing.
   c. Vibration: IEC 68-2-6 and IEC 68-2-27.
3. Performance:
   a. Standards Supported:
      1) Ethernet (10 Mb/s).
      2) Fast Ethernet (100 Mb/s).
      3) Gigabit Ethernet (1,000 Mb/s).
   b. Compliance: IEEE 802.3.
   c. Topologies Supported: Device-Level Ring, Standard Ring, Linear, Star.
4. Features:
   a. Failure of any one device does not restrict the traffic amongst any other devices. Failure of any one cable does not restrict any traffic around the ring.
   b. Network Media: Any standard Ethernet, copper or fiber. Module selection determines the number of ports for each type of media.
   c. Base Unit: Two sizes available. Small Style supports up to 8 network ports, and Large Style supports up to 24 network ports.
   d. Size and Configuration:
      1) Fiber Ports: Two each minimum, 100Base-FX, single mode, SC/LC sockets, to suit two fibers per port.
      2) Copper Ports: Six each minimum, 100Base-T/TX, RJ45 sockets.
   e. Diagnostic LED Indicators:
      1) Link status.
      2) Data/activity.
   f. RMON: Statistics, history, alarms, events.
   g. Port mirroring.
   h. VLAN support.
   i. Rapid Spanning Tree Protocol.
   j. Port security.
   k. Fault Signal: Pick either one of the following depending on manufacturer selected:
      1) Dry contact, rated 1A at 24V dc.

5. Mounting: DIN rail, 35 mm.
6. Power: Redundant voltage inputs, 18V dc to 31V dc, with automatic switchover to secondary power source upon failure of primary source.
7. Network Segregation:
    a. Provide separate network switches for PLC network and for motor control network.
    b. Coordinate with Buyer and PCS System Integrator for IP address assignments.
8. Configuration:
    a. MPCS to configure switches used for MBR PLC network, between Main PLC and Train PLCs or Remote I/O nodes. Configuration to include all required functionality to ensure high availability of network ring, including failure/break scenarios.
    b. MPCS to configure switches used for motor control network with the partnership of the PCS System Integrator. Configuration will be consistent with Plant motor control networks. Prior coordination of configuration shall be required.
9. Testing and Validation:
    a. Device Level Ring, Standard Ring, and Star topology should be tested/demonstrated/documented at FAT and again onsite as an early part of SAT.
    b. Test needs to include loss of switch, fiber segment, etc., to verify redundancy scheme is working as intended and appropriate alarms are received at OIU and PCS.
10. Manufacturer and Product: Allen Bradley; Stratix 5700; 1783-BMS10CGP.

2.08 OPERATOR INTERFACE UNIT (OIU)

A. General:

1. Provide graphical interface for operator to monitor and control from panel-mounted location at remote sites.
2. Program OIU application software to control and monitor local devices within the entire membrane system or individual trains.
3. OIU application shall follow the Graphical User Interface guide in Section 40 99 90, Package Control Systems, Supplement, and Application Software section listed below.

B. Performance:

1. Panel Rating: NEMA 4/4X, IP65.
2. Memory: 82 MB for project memory.
3. Power Input: 10.2V dc to 26.4V dc, 29W maximum.

4. Hot-swappable SD card slot for transferring files, upgrading firmware or logging program data.

C. Display:

1. Size 15-inch display.
2. Type: Color active-matrix TFT, 8-wire analog resistive touchpanel capability.
3. Resolution: 1024 by 768 XGA, 64k color graphics.
4. Luminance: 280 nits.
5. Backlight: 50,000 hour life at 25 degrees C.

D. Communication/Networking/Ports:

1. Three serial communication ports (RS-232/422/485).
2. One Ethernet communication port (RJ-45).
3. Two USB 2.0 host ports for connecting USB mouse, keyboard, etc.
4. Two SD card slots, each 2 GB.
5. One HDMI output port.
6. One audio line output port.

E. Manufacturer and Product:

1. Allen-Bradley; Panelview Plus 7.
2. "Or-equal."

2.09 APPLICATION SOFTWARE FOR ETHERNET NETWORK CONNECTED PLC(S)

A. PLC Application Software Development Methodology: The programmable controller system (PLC) is required to communicate over a fiber optic data link with HMI servers and other PLCs to be provided by others. It is extremely important that each PLC is programmed in a way that allows efficient data exchange between the HMI, other PLCs and this PLC. Coordinate data communication with the PCS System Integrator.

1. All control and monitoring features of the package system HMI shall be available over the Plant SCADA control system.
2. PLC shall be programmed using ladder logic.
3. All data tags, including timers and the like, shall be scoped as controller tags and available for data exchange.
4. Provide annotated data exchange look up tables and other information to allow the PCS System Integrator to implement efficient data exchange between HMI and PLC.

B. The data exchange table must be submitted for approval with the overall Membrane Control System plan.

C. Software Design Submittal: This submittal shall be a detailed description on the application program. Submit this material during the program development stage. Provide ladder logic programs to implement all functional requirements specified in applicable process specifications. This submittal shall be reviewed by the Engineer prior to the submittal of the Preliminary Software Documentation.

D. Preliminary Software Documentation: Provide this submittal at least 4 weeks prior to the Factory Test. Here the term "preliminary" refers only to the timing of this submittal, not the level of detail to be provided. This submittal shall be a fully detailed version of all the material described under O&M Manual, Software Documentation.

E. Provide format of reports to be generated by HMI using data received from the PLC. Provide any required calculation procedures.

2.10 INSTRUMENT TAG NUMBERS

A. A shorthand tag number notation is used. For example:

40-AIT-1012A [pH]

Notation	Explanation
40	Plant facility designator
	(40 = Membrane System for this project)
AIT	ISA designator for Analytical Indicating Transmitter
10	Unit process number
12	Sequence number/loop number
A	Suffix for multiple number of same component types in a given loop
[pH]	Same notation shown at 2 o’clock position on ISA circle symbol on Process and Instrument Diagram

In this example, the entire Loop Number is 401012.

2.11 NAMEPLATES, NAMETAGS, AND SERVICE LEGENDS

A. Nametags: Permanently mounted bearing entire ISA tag number.

1. Panel Mounted: Plastic, mounted to instrument behind panel face.

2. Field Mounted: Engraved Type 316 stainless steel, 22-gauge minimum thickness, attached with stainless steel.

B. Service Legends (Integrally Mounted with Instrument) and Nameplates:

1. Engraved, rigid, laminated plastic type with adhesive back. Furnish service legends and nameplates to adequately describe functions of panel face mounted instruments.
2. Color: White with black letters.
3. Letter Height: 3/16 inch.
4. For each panel, face mounted laminated nameplate inscribed with the panel name and tag number. Color shall be white with black letters 1/2 inch high.

C. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
ON	ON	Green
OFF	OFF	Gray/White (TBD)
OPEN	OPEN	Green
CLOSED	CLOSED	Gray/White (TBD)
LOW	LOW	Yellow/Amber
FAIL	FAIL	Red
HIGH	HIGH	Yellow/Amber
AUTO	AUTO	TBD
MANUAL	MANUAL	TBD
LOCAL	LOCAL	TBD
REMOTE	REMOTE	TBD
FORWARD	FORWARD	Green
REVERSE	REVERSE	Green

1. Lettering: Black on white and amber lenses; white on red and green lenses.

2. Standard Pushbutton Colors and Inscriptions:
   a. Use following unless otherwise noted in individual Loop Specifications:

Tag Function	Inscription(s)	Color
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

   b. Lettering Color:
      1) Black on white and yellow buttons.
      2) White on black, red, and green buttons.

2.12 SOURCE QUALITY CONTROL

A. General:

1. Test control system elements, both hardware and software, to demonstrate that the control system satisfies requirements.
2. Factory Tests Described Under this Article:
   a. Unwitnessed Factory Test.
   b. Factory Acceptance Tests (FAT).
3. Onsite Tests Described Under Part 3, Execution:
   a. Preparation for Testing.
   b. Functional Tests.
   c. Performance Tests.
4. Test Format: Cause and effect.
   a. Person conducting test initiates an input (cause).

b. Specific test requirement is satisfied if correct result (effect), occurs.

5. Procedures, Forms, and Checklists:
   a. Except for Unwitnessed Factory Test, conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
   b. Describe each test item to be performed.
   c. Have space after each test item description for signoff by appropriate party after satisfactory completion.
6. Required Test Documentation: Test procedures, forms, and checklists. Signed by System Supplier.
7. Conducting Tests:
   a. Special testing materials and equipment.
   b. Wherever possible, perform tests using actual process variables, equipment, and data.
   c. If not practical to test with real process variables, equipment, and data, provide suitable means of simulation.
   d. Define simulation techniques in test procedures.
8. Coordinate testing with Buyer and Engineer, who will actively participate in many of the tests.
9. PCS Control System Integrator or Buyer reserves right to test or retest all specified functions whether or not explicitly stated in test procedures.
10. Engineer's decision will be final regarding acceptability and completeness of all testing.
11. Excessive Test Witnessing: Buyer will recover costs for witnessing retesting of corrected or replaced defective Work, and for return visits to manufacturing facilities to witness Factory Demonstration Tests or retesting.

B. Unwitnessed Factory Test:

1. Scope: Inspect and test control system to ensure it is operational, ready for FAT.
2. Integrated Test:
   a. Interconnect and test control system, except for primary elements.
   b. Exercise and test all functions.
   c. Simulate inputs and outputs for primary elements, final control elements.

C. Factory Acceptance Tests (FAT):

1. Scope: Test entire control system, with exception of primary elements and final control elements, to demonstrate that it is operational and conforms to specified requirements and related Submittals.
2. Provide all application programming necessary to test the complete system.

3. Loop-Specific Functions:
    a. Demonstrate functions shown on P&IDs, described in the Specifications and Submittals.
    b. Verify all OIU and PLC functions through indications on the OIU and the PLC programming software.
    c. Demonstrate all manual and automatic functions, interlocks, and alarms are operating as specified, and verify outputs and inputs are configured to the correct PLC I/O point.
4. Non-Loop-Specific Functions:
    a. Demonstrate that all I/O and software are functional.
    b. Capacity: Demonstrate that control system has required spare hardware capacity for expansion.
    c. Timing: Include tests for timing requirements.
    d. Diagnostics: Demonstrate online and offline diagnostic tests and procedures.
5. Communications: Demonstrate communications between all components.
6. Control system ready to communicate with the Plant Control System components via the Ethernet network. Demonstrate that:
    a. PLCs can communicate and exchange the specified I/O point data with other PLCs and Plant Control System HMI PCs using specified protocols.
7. Correct deficiencies found and complete retesting prior to shipment to Site.
8. Failed Tests:
    a. Repeat and witnessed by Membrane Control System Integrator.
    b. With approval of Membrane Control System Integrator, certain retesting may be conducted by supplier and witnessed by Membrane Control System Integrator as part of Functional Test.
9. Make following documentation available to PCS Control System Integrator at test site both before and during FAT:
    a. All Drawings, Specifications, Addenda, and Change Orders.
    b. Master copy of FAT procedures.
    c. List of equipment to be tested including make, model, and serial number.
    d. Shop Drawing, Samples and Technical Data hardware Submittals for equipment being tested.
    e. Software documentation Submittal.

PART 3 EXECUTION

3.01 ELECTRICAL POWER AND SIGNAL WIRING

A. Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.

B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.

C. Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.

D. Do not splice or tap wiring except at device terminals or terminal blocks.

3.02 PROTECTION

A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

B. During Work, periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules at Substantial Completion.

3.03 FIELD QUALITY CONTROL OR SITE ACCEPTANCE TESTS (SAT)

A. General: All requirements listed in Paragraph General under Article Source Quality Control also applies to this article.

B. Onsite Supervision:

1. Membrane Control System Integrator Site representative to supervise and coordinate onsite control system activities.
2. Membrane Control System Integrator Site representative shall be onsite while onsite work covered by this Specification and control system subsystems is in progress.

C. Control System Commissioning and Testing Team:

1. Thoroughly check installation, termination, and adjustment for control system.
2. Complete onsite tests.
3. Assist with integration and testing of Plant Control System interface and communications.
4. Complete on-site training.

D. Preparation for Testing, and Functional Testing: Prior to commissioning and Performance Test period, inspect, test, and document that associated control system equipment, including PLCs and communication equipment, and computers, is ready for operation. Conduct in two parts, as follows:

1. Preparation for Testing: Performed by Membrane Control System Integrator to test and document that the control system is ready for operation.
    a. Loop/Component Inspections and Tests:
        1) Check control system for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.
        2) Provide space on forms for signoff by Membrane Control System Integrator.
        3) Use loop status report to organize and track inspection, adjustment, and calibration of each loop and include the following:
            a) Loop number.
            b) Tag number for each component.
            c) Checkoffs/Signoffs for Each Component:
                (1) Tag/identification.
                (2) Installation.
                (3) Termination wiring.
                (4) Termination tubing.
                (5) Calibration/adjustment.
            d) Checkoffs/Signoffs for the Loop:
                (1) Panel interface terminations.
                (2) I/O interface terminations with PLCs.
                (3) I/O Signals for PLCs are Operational: Received/sent, processed, adjusted.
                    (a) Total loop operational.
                    (b) Space for comments.
        4) Component calibration sheet for each active component (except simple hand switches, lights, gauges, and similar items) and each PLCs I/O module and include the following:
            a) Loop number.
            b) Component tag number or I/O module number.
            c) Component code number.
            d) Manufacturer.
            e) Model number/serial number.
            f) Summary of Functional Requirements, for Example:
                (1) Indicators and recorders, scale and chart ranges.
                (2) Transmitters/converters, input and output ranges.

(3) Computing elements' function.
(4) Controllers, action (direct/reverse) and control modes (PID).
(5) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
(6) I/O Modules: Input or output.

5) Calibrations, for Example, but not Limited to:
a) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
b) Discrete Devices: Actual trip points and reset points.
c) Controllers: Mode settings (PID).
d) I/O Modules: Actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
e) Space for comments.

6) Maintain loop status reports, valve adjustment sheets, and component calibration sheets at Site and make them available to Engineer at all time.

7) These inspections and tests will be spot checked by Engineer.

8) Engineer reviews loop status sheets and component calibration sheets and spot-check their entries periodically, and upon completion of Preparation for Testing. Correct deficiencies found.

b. Factory Demonstration Tests-Repeat:
1) Repeat FAT onsite with installed control system equipment and software.
2) Certain portions of the FAT may not require retesting.
3) Use FAT test procedures as basis for this test.
4) In general, this test shall not require witnessing. However, portions of this test, as identified by Engineer during original FAT, shall be witnessed.

2. Functional Test: Confirm that control system, including applications software, and communications with Plant Control System is ready for operation.
a. Prerequisite: Completion of Preparation for Testing.
b. Application software tests using installed equipment. Plant interlocking and communications with PLCs, Plant Control System tested on loop-by-loop basis.
c. Test procedures provided by Membrane Control System Integrator.

E. Performance Tests Prior to Facility Commissioning:

1. For individual standalone equipment that can be tested properly before the facility commissioning period begins.
2. Testing in accordance with Paragraph Performance Testing During and After Facility Commissioning.

F. Performance Test During and After Facility Commissioning:

1. Once a facility's Functional Test has been completed and the facility commissioning period has begun, conduct a Performance Test on the associated control system equipment to demonstrate that it is operating as required by the Specification. Demonstrate each required function on a paragraph-by-paragraph and loop-by-loop.
2. Loop-specific and non-loop-specific tests same as required for FAT except that entire installed control system tested using actual process variables and all functions demonstrated.
3. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
4. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of Process equipment is not possible.
5. Make updated versions of documentation required for Performance Test available to Engineer at site, both before and during tests.
6. Assist with testing of the Plant Control System functions, interfaces, and communications.

3.04 TRAINING

A. Instrumentation and Control Operation:

1. Content: Provide training on a loop-by-loop basis.
   a. Loop Functions: Understanding of loop functions, including interlocks for each loop.
   b. Loop Operation: How to perform the various functions provided by the control system. For example, adjusting process variable set points, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.
2. Duration of Training Session: Two class days, minimum.

B. Instrumentation and Control Maintenance:

1. Content: Provide training for each type of component and function provided.
    a. Loop Functions: Understanding details of each loop and how they function.
    b. Component calibration.
    c. Adjustments: For example, controller tuning constants, current switch trip points, and similar items.
    d. Troubleshooting and diagnostics for all components.
    e. Components removal and replacement. For example, modules, lamps, fuses, etc.
    f. Periodic maintenance.
2. Duration of Training Session: Two instructor class days, minimum.

C. PLC Maintenance and Software:

1. Content:
    a. Overview of Configuration, programming, maintenance, and troubleshooting for PLC equipment supplied.
    b. PLC program backup and restore procedures.
    c. Network communication.
    d. PLC hardware configuration and maintenance specific to the delivered system.
2. Duration of Training Session: One day.

D. OIU Software:

1. Content:
    a. Basic Operation and configuration of OIU standard software products provided.
    b. Review of specific OIU application provided for this Project.
    c. Database configuration.
    d. Display building.
    e. Alarm, trending, and analysis tools.
    f. Historical archive and calculation tools.
    g. Network communication, data highway interface/exchange.
2. Duration of Training Session: One class day, minimum.
3. Location: Project Site.

3.05 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this Specification:

1. Graphical User Interface Design Guide.

END OF SECTION

GRAPHICAL USER INTERFACE DESIGN GUIDE

1.01 OVERVIEW

A. General:

1. This Section of the design guide focuses on the general graphics design philosophy as well as the specific design elements of the Membrane Package Control Subsystem (MPCS).
2. The primary objective of the MPCS graphical user interface design is to convey accurate information to all users so they can make informed management, operations and control decisions.
3. This design guide is intended to outline MPCS graphic design guidelines, not develop rules for every situation. This design guide is intended to provide the frame work for the MPCS designer to develop a concise process control information and control system.
4. Implement the ISA and ASM guidelines for highly effective operator interfaces.

1.02 GUI DEFINITION

A. General:

1. The Graphical User Interface (GUI) is the graphical part of the MPCS system.
2. The GUI is implemented in the Operator Interface Workstation using the HMI software.

1.03 DESIGN OBJECTIVES

A. Design Considerations:

1. The approach to designing the GUI is to convey information on complex plant operations into manageable units that are intuitive.
2. The following outlines key objectives in designing the GUI:
   a. Easily navigated menus.
   b. Provide no more than three mouse or touch-screen actions to navigate to any control display.
   c. Maintain consistency in graphic display and controls design.
   d. Maintain consistent and predictable window operations.
   e. Accurate representation of the plant and its operations.
   f. Provide control and monitoring information in two forms, so that color is not the sole means of determining system or equipment status.
   g. Represent control options in an easily understood fashion.

h. Develop help screens to provide additional information to help the operations staff understand the control options where complex operations are required.

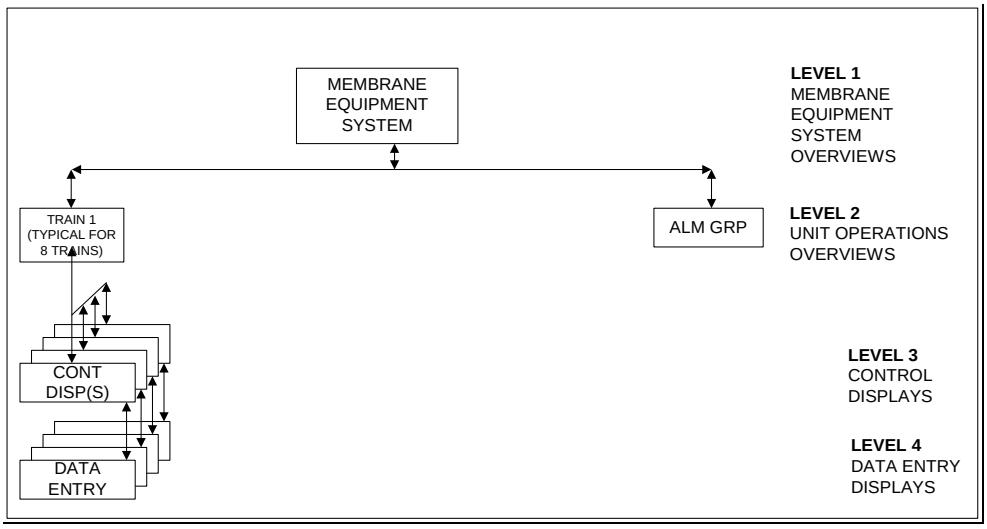
i. Where possible, design overview displays similar to the physical layout of the facility. The perspective to the physical layout should be from the local main control room.

j. Provide Operator Access to Process and Alarm Set Points, including the following:
   1) Process Alarms (High-High, Hi, Low and Low-Low).
   2) Pump and Equipment Control Set Points.
   3) Process timer set points.
   4) Sequence set points for volume, level, time, etc.

1.04 GENERAL DISPLAY ORGANIZATIONAL PHILOSOPHY

A. General:

1. Custom graphic displays provide the vehicle for the operations to accomplish supervisory control over the entire membrane equipment system process. The supervisory control system will support many custom and standard type graphics displays. Organization of these graphics displays into a consistent homogeneous hierarchy permits fast, easy and logical navigation between the displays. The following figure illustrates an overview of a typical graphic display hierarchy.



2. As shown, the process and control graphic display hierarchy consists of four levels of displays. The following briefly describes the intent of each of the four levels of displays:

B. Level 1 – Membrane Equipment System Overview(s):

1. The Membrane Equipment System Overview(s) show major processes or subsystems such as permeate system, cleaning systems, etc. These overview displays show the most important (essential) process data and major equipment status on a system wide basis, but provide no equipment or system control.
2. The Membrane Equipment System Overview(s) display provide the means to page (i.e., go to) directly to Control Displays.
3. As a general rule, the Membrane Equipment System Overview(s) show the most critical status and system data that give the operations staff a good general feel on how the process, is currently operating.

C. Level 2 - Train Process Overviews:

1. Train Process Overviews are full sized screens.
2. The Train Process Overviews show primary process data on each train including unit operations, equipment status, or system status, etc. As a general rule no control strategies are implemented through the Train Process Overviews. The train operations overview provides the means to access Control Displays.
3. Train Process Overviews provide the means to access control displays.
4. The general rule is to show process data, system and equipment status that gives operations staff a good general feel on how the individual train are currently operating. It also provides a launching pad to access control information associated with the individual trains.
5. Access to subsystems, i.e., control displays, will through popup windows launched from the overview. The Overview can be considered the parent display and the associated control displays are child displays. When a control display is opened the overview will remain open.

D. Level 3 - Control Displays:

1. Control Displays can be Full screen or popup windows.
2. Control Displays provide the means to monitor and provide Supervisory Control of specific process operations. Depending on the complexity of the specific process there may be several levels of displays. Control of each piece of equipment on individual unit operation control displays is possible, but you may need to go to sequence displays to actually select sequence options.

3. Supervisory Control: The objective of the MPCS design approach is to implement all Supervisory Control of the membrane equipment system and its process and control strategies from the control displays. The control strategies include the following functions:
    a. System level control, such as control loops, and sequences etc.
    b. Equipment level control, such as a pump start/stop control.
    c. Detailed monitoring of sequence steps and general information messages for status.
    d. Important alarm messages.
    e. Paging between related displays.
    f. Paging between related processes.
4. Popup Windows: Popup windows provide the capability to control systems and equipment with out cluttering the overview or control display. Popup window philosophy will be discussed in detail in the following sections.

E. Level 4 – Set Point and Data Entry Displays:

1. Alarm Set Points: Special data entry screens shall be developed for entering alarm set points, and equipment control set points, such as lead-lag pump start/stop set points.
    a. Alarm Set Points: Set points for process variable alarms shall be implemented through an indicator object or faceplate.
    b. Equipment Control Set Points: Set points for equipment control shall use a standard recessed data entry object located next to the associated process variable indicator. Provide a brief but meaningful description of the set point.
    c. The set point popup shall be accessed from the alarm indication on the control display. If room on the unit process display is available without cluttering it up the set point display can be located on it.

F. Process Variable Trend Displays: Trend Displays are provided to provide the O&M a means to determine how the process has been running to help determine how to operate it in the future. Trend displays are often designed as part of control displays rather than separate displays.

1.05 MISCELLANEOUS DISPLAYS

A. General: The GUI provides a vehicle to develop specialty graphic screens for engineering and maintenance. These displays are generally not used by the plant operational staff and may not be available through the normal navigation menus.

B. Loop Tuning Displays:

1. A loop tuning display shall be provided for each PID controller. The objective of the Tuning displays is to provide the means to set the controller tuning constants.
2. Each Loop tuning display shall have a trend graph that as a minimum trends the process variable, set point, Controller output.

1.06 GRAPHIC SCREEN CONTROLS AND INDICATION CONVENTIONS

A. General:

1. The Objective of this section is to outline the general requirements for equipment and system controls from a picture. The pictures provide the platform for monitoring and executing the control functions. It is important for the Operations staff to clear understanding of current operation conditions and information such that good operational decisions can be made then executed.
2. As previously indicated the controls are classified as either System level controls or Equipment level controls. System level controls are implemented on the control screen and equipment level controls are implemented through popup windows.

B. Mode Control Buttons:

1. Mode control buttons will be used to control system modes, such as LEAD/LAG selection multiple mode of control, etc.
2. For mode controls the standard Pushbutton shall be used. The following outline the functional criteria for control buttons.
    a. The term ENABLED is used to define a control button, selection, switch, etc., on the display that is available or accessible to the operator for control. Conversely, the term “Disabled” is used to define a button, selection, switch, etc., on the display that is not available or enabled to the operator for control. An example of an inactive control button would be if a motor is “Not in REMOTE” in the field, then the motors start and stop buttons at the display would be inactive because the motor is not available for remote control.
    b. Disabled control buttons will be colored the standard/medium gray and the "Enable" Behavior shall be false.
    c. Enabled control buttons other than start/stop will be dynamically colored based on wither the mode is selected mode is ON or OFF, green is ON and gray is OFF. The following list examples of control button colors.
        1) Auto: Blue when in Auto, White when in Manual and light gray when disabled or Local.

2) Manual: White when in Manual, Blue when in Auto and light gray when disabled or Local.

C. Alarms:

1. Alarms are defined as process control conditions such as High level, Low Flow, Signal Loss, etc.
2. Most Alarms shall be shown on the control displays and not on the overviews. Note: The Designer shall use his/her discretion on which alarms to be shown on control displays. The objective of showing alarms on a control display is to communicate to the operator key alarms such that he can make good operating decisions without going back the alarm summary.

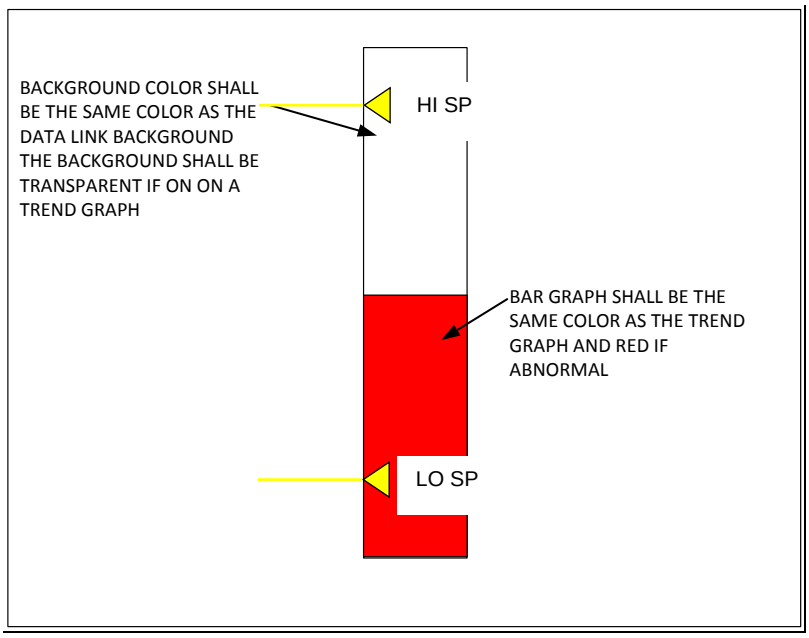
D. Failures:

1. Failures are defined as equipment or system failures. Generally equipment failure are indicated by the Fail color of the background behind the pump, valve or device. In some cases a failure message may also placed on the control graphic.
2. Data Values: Data values are numeric datalinks that display the value of process variables such as flows, pressure, levels, etc.

E. Bar Graphs:

1. Used to graphically display analog levels and process variables where it is important to show value graphically as well as a textual value.
2. Any time a level set point is displayed to entered for a tank on the screen, the set point shall be positioned relative to the set point entered and the bar graphic itself. This can be done using arrows or lines to indicate set point
3. Bar graphs shall be used for all critical analog values. Horizontal bar graphs shall be used for pressure, flow or analytical values with upper and lower limits.

4. The following illustrates the bar graph convention for level value.



F. Equipment Symbols On Graphic Screens: In general graphic symbols show the status and operating mode of a controllable device, pump, valve, mechanical device.

COLOR AND GRAPHIC CONVENTIONS

2.01 COLOR CONVENTION

A. General:

1. Use color and shape coding to improve the operator's ability to perceive relevant information. A key objective is to use colors consistently to add to the understanding of the desired message.
2. In a screen that is highly congested, color can help to highlight special groups of information.
3. A light gray background has worked well, however, the use of a specific background color is left to the developer.
4. Color convention shall be coordinated with Engineer prior to software development.

B. Static Objects:

1. Static objects include such objects like process lines, static text, static symbols, etc.
2. The static object colors should be chosen to compliment the rest of the display in order to make the changes of dynamic objects more obvious and the entire display more appealing to the observer.

C. Dynamic Objects:

1. Most dynamic objects shown on pictures shall be grouped objects.
2. Bold/bright colors will be used to help draw operator attention to the changing event. Normal displays of dynamic data will use colors like Blue, Purple, Green. Colors like Yellow and Red will be reserved for alarm or upset conditions. Colors such as Orange should be used for Calibration or Caution.

SECTION 43 12 01
COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME): PTC 10, Compressors and Exhausters.
2. American Water Works Association (AWWA): E101, Vertical Turbine Pumps-Line Shaft and Submersible Types.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. MG 1, Motors and Generators.

1.02 DEFINITIONS

A. Standard Cubic Foot Per Minute (scfm): Volume flow rate of air at standard conditions of 68 degrees F, 14.7 psia, and 36 percent relative humidity.

1.03 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

B. Action Submittals:

1. Shop Drawings:
   a. Make, model, weight, and horsepower of each equipment assembly.
   b. Manufacturer's catalog information, descriptive literature, and specifications.
   c. Detailed mechanical and electrical drawings showing equipment fabrications. Include dimensions, size, and locations of connections to other Work.
   d. External utility requirements such as air, water, power, and drain for each component.
   e. Functional description of internal and external instrumentation and controls including list of parameters monitored, controlled, or alarmed.
   f. Control panel elevation drawings showing construction and placement of operator interface devices and other elements.

g. Schedule listing air uses and giving justification for the methodology of sizing the compressors.
h. Motor data per Section 26 05 01, Electrical.
i. Manufacturer's diagrams for air compressor piping.
j. Equipment weight, center of gravity, anchor bolt layout, anchor bolt spacing, and other pertinent information required to anchor the equipment.

C. Informational Submittals:

1. Manufacturer's recommended vibration limits of compressed air system.
2. Manufacturer's Instructions:
   a. Installation of equipment.
   b. Installation of vibration isolators.
3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.
4. Operation and Maintenance Data: As specified in Section 01 30 00, Administrative Requirements.

1.04 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

1. V-Belts: One set per compressor type.
2. Intake Filter Cartridges: Three per compressor type.
3. Prefilter Replaceable Elements: Five for each compressor type.
4. Oil Filter Replaceable Elements: Three for each compressor type.
5. Special Tools: One set.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. General:

1. Furnish air compressors as a complete system that includes compressor, motor, controls, and accessories.
2. Reference data sheet located at the end of this section as a supplement.
3. Provide a minimum of two air compressors, each with their own integral air receiver (one duty plus one installed spare); and two regenerative desiccant air dryers (one duty plus one installed spare).
4. Size each compressor to provide required airflow for all instruments, eductors, and valves that may operate simultaneously, plus continuous losses associated with all items that passively use air. Assume 15 percent leakage in piping.

B. Receiver Mounted Air Compressor(s):

1. Manufacturers and Products:
   a. ITT; Pneumotive.
   b. Gast.
   c. Quincy.
   d. Gardner Denver.
2. Two-cylinder, two-stage reciprocating type.
3. Air cooled.
4. Oil pressure lubricating system.
5. Automatic unloading during startup.
6. Mount motor and compressor on common steel base attached to receiver.
7. Compressor connected to motor by V-belt drive system with guard, and convenient method of belt tensioning.
8. Operate at 1800 rpm. Capable of operating continuously at vc.
9. Equip with combination air intake filter silencer, oil filter, and discharge cushion chamber.
10. Capacity: As required by membrane supplier.
11. Operating Discharge Pressure: As required by membrane supplier.
12. Adjustable Control Pressure: As required by membrane supplier.
13. Receiver Capacity: As required by membrane supplier.
14. Motor:
    a. See Datasheet at the end of this section.
    b. Connected Load: Do not exceed motor nameplate horsepower rating for operating conditions.
    c. Minimum Full-Load Efficiency: Not less than 93 percent.
15. Receiver:
    a. Horizontal welded steel receiver bearing ASME code stamp and with inspection openings.
    b. Maximum Allowable Working Pressure: As required by membrane supplier.
    c. Corrosion Allowance: 1/16 inch.
    d. Safety relief valve set for 135 psig.
    e. Pressure gauge with gauge cock.
    f. Automatic condensate drain valve with isolation valve.
    g. Manual blowdown valve located at low point in receiver.
16. Aftercooler (Water Cooled):
    a. Receiver mounted.
    b. Maximum working pressure of 150 psig.
    c. Placed between compressor discharge and receiver.
    d. Rated Capacity: Cool to within 15 degrees of water temperature.
    e. Locate moisture separator downstream of aftercooler and include automatically trapped drain.

17. Controls:
    a. ON/OFF cyclic operation.
    b. Automatic low oil pressure shutdown with indicating light and oil pressure gauge.
    c. Enclosure:
        1) NEMA 250, Type 12 panel for indoor installation to house complete control system including:
            a) Control power transformer.
            b) HAND/OFF/AUTOMATIC switch.
            c) Pressure switches.
            d) Relays.
            e) System pressure indicator.
            f) Indicating light(s).
            g) Combination motor starter (NEMA Size 1 minimum) with overload protection.
    d. Control Panel: Mount in accessible location on receiver.
    e. Prewired control components.
    f. Control Components: Operate on 120V ac power supply.
    g. Power Supply: 480 volts, three-phase, 60-Hz.
        1) Provide main circuit breaker with through-door, padlockable operating handle.

C. Regenerative Desiccant Air Dryer:

1. Manufacturers:
    a. Wilkerson Corp.
    b. Pall Trinity Micro.
    c. Zurn.
2. Air Dryer:
    a. Dual drying chambers and control system, complete, skid mounted.
    b. Rated Outlet Flow: As required by membrane supplier.
    c. Pressure Dew Point: Minus 40 degrees F with 100 degrees F inlet air and 100 degrees F ambient air temperature.
    d. Maximum Working Pressure: 150 psig.
    e. Provide two ASME code rated chambers utilizing a heaterless regeneration design.
    f. Fill towers with activated alumina desiccant on stainless steel supports to help prevent channeling of the air.
    g. Provide drain and fill ports for each tower without piping disconnects.
3. Dryer Interconnecting Piping:
    a. Provide check valve in each tower discharge line and a four-way switching valve in inlet air piping.
    b. Furnish purge air piping for tower drying.

c. Equip purge discharge line with purge air muffler.
d. Equip purge air supply line with flow regulating device, factory adjusted and locked in position.
e. Supply purge air from discharge side of the dryer and provide with air filter upstream of control connections.
f. Pipe purge air to flow through the tower countercurrent to the process air.
g. Equip each tower with ASME code rated safety relief valve and pressure gauge.
h. Dryer preassembled with interconnecting piping installed.

4. Dryer Control System:
   a. Automatically alternate towers for regeneration to provide an uninterrupted air supply without downstream pressure fluctuations.
   b. Equalize pressures in both desiccant chambers prior to changeover.
5. Switching Valve:
   a. Provide to change a tower from drying mode to regeneration mode.
   b. Type: Four-way, enclosed, pneumatic cylinder-operated, nonlubricated and equipped with Teflon sealing surfaces.
   c. Control switching valve with four-way solenoid valve to direct dry air to air cylinder on the control valve.
   d. Electrical Power Supply to Control System: 120 volts, single-phase.
6. Filter Accessories:
   a. Coalescing Prefilter:
      1) Provide to protect desiccant bed from oil or free water contamination in compressed air supply.
      2) Capable of removing 100 percent of aerosols 0.75 micron and larger, and 100 percent of 0.3-micron solid particles.
      3) Include automatic float drain.
   b. Particulate Afterfilter:
      1) Protect air-lines from desiccant dust fines carried over from desiccant towers.
      2) Capable of removing 100 percent of 1 micron and larger particles.

D. Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 100 pounds.

E. Equipment Identification Plates: Provide 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component and control panel in a readily visible location. Plate shall bear 3/8-inch high

engraved block type black enamel filled equipment identification number and letters.

2.02 ACCESSORIES

A. Flexible Discharge Connection Manufacturer and Product: U.S. Flex; BMH.

B. Safety Valve:

1. Manufacturers:
   a. Consolidated.
   b. Crosby.
2. Fabrication: Bronze body, bronze base, disc with steel spring, top outlet, and malleable iron lifting lever.
3. In accordance with ASME Code for Unfired Pressure Vessels.
4. Set to relieve at pressure and full capacity as determined by membrane supplier.

C. Automatic Drain Trap (ADT-2):

1. Manufacturer and Product: Armstrong; No. 213BVSW.
2. Inverted bucket type for liquid drainage.
3. Fabrication:
   a. Bucket and Leverage System: Stainless steel.
   b. Valve and Seat: Hardened chrome steel.
   c. Body and Cap: Cast iron.
4. Priming plug in cap and drain plug in body.
5. Provide 1/2-inch diameter NPT inlet and outlet connections.
6. Working Pressure: 150 psig.

D. Oil Removal Filters:

1. Manufacturer and Product: Wilkerson Corp.; Microalescer with matching prefilter.
2. One oil removal filter in the air piping, with matching prefilter as follows:
   a. Prefilter: A 5-micron cleanable element.
   b. Oil Removal Filter: Remove 99.9 percent of 0.3-micron lubricating oil from 100 psig air.
   c. Automatic drain valves on filters.
   d. Arrange filters so elements shall be replaced without removing filters from the line.
   e. One extra filter element for each filter.

E. Vibration Isolators: Furnish Standard Vibration Isolators used by manufacturer for Compressors. Coat with System No. 5 of Section 40 27 00, Process Piping—General, or furnish in Type 304 or Type 316 stainless steel.

2.03 SHOP/FACTORY FINISHING

A. Furnish manufacturer's standard baked enamel finish.

2.04 SOURCE QUALITY CONTROL

A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

B. Factory Tests and Adjustments: Test all equipment and control panels actually furnished.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on each piece of equipment in the system.

1. Vibration Test:
   a. System shall not develop amplitudes of vibration in excess of manufacturer's recommendations.
   b. Test with units installed and in normal operation.
   c. If units exhibit vibration in excess of the limits adjust or modify as necessary. Units which cannot be adjusted or modified to conform to manufacturer's recommendations shall be replaced.

B. Performance Test:

1. Conduct on each compressor assisted by manufacturer's representative.
2. Perform under actual or approved simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Perform with Engineer present.
5. Adjust, realign, or modify units and retest.

3.02 MANUFACTURER'S SERVICES

A. Provide the following manufacturer's services in coordination with the installing Contractor.

B. Manufacturer's Representative: Present at Site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.
2. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
3. 1 person-day for prestartup classroom or Site training of Owner's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by Engineer.

3.03 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification:

1. Induction Motor Data Sheet.

END OF SECTION

INDUCTION MOTOR DATA SHEET

Project: San Luis Obispo WRRF

Owner:

Equipment Name: Compressed Air System

Equipment Tag Number(s): To Be Determined

Type: Squirrel-cage induction meeting requirements of NEMA MG 1

Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Horsepower: As required

Guaranteed Minimum Efficiency at Full Load: 93 percent

Voltage: 480

Guaranteed Minimum Power Factor at Full Load: _____ percent

Phase: 3

Service Factor (@ rated max. amb. temp.): ☐ 1.0 ☒ 1.15

Frequency: 60

Enclosure Type: TEFC

Synchronous Speed: <1800 rpm

☐ Thermal Protection: _____

☐ Space Heater: _____ volts, single-phase

Mounting Type: ☒ Horizontal ☐ Vertical

☐ Vertical Shaft: ☐ Solid ☐ Hollow

☐ Vertical Thrust Capacity (lb): Up _____ Down _____

Additional Motor Requirements: ☒ See Section 26 05 01, Electrical.

Special Features:

SECTION 43 32 56
MEMBRANE EQUIPMENT SYSTEM
(MEMBRANE BIOREACTOR)

PART 1 GENERAL

1.01 SUMMARY

A. This section provides a detailed description of the Goods to be furnished under this Contract between the Contractor and the Seller for a Membrane Equipment System for the City of San Luis Obispo (Buyer) at the Water Resource Recovery Facility (WRRF).

B. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures to be provided under this Contract by the Seller.

C. Refer to Section 01 43 34, Special Services, for a listing of the Special Services to be provided under this Contract by the Seller.

D. Refer to Section 26 05 01, Electrical, for motor and miscellaneous electrical requirements.

E. Refer to Section 40 91 00, Instrumentation and Control Components.

F. Refer to Section 40 99 90, Package Control Systems, and control panel requirements.

1.02 DESIGN REQUIREMENTS

A. Design of all systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of the 2016 edition of the California Building Code, Part 2 of Title 24 and all other applicable local agencies, and the following conditions:

1. Wind: Basic wind speed, V: 115 mph, with Exposure Category C, and Risk Category III.
2. Snow Load: Basic ground snow load, not applicable.
3. Seismic: Risk Category III, Site Class Definition E, seismic importance factor, I, of 1.25, component importance factor I_P equals 1.0, unless noted otherwise. I_P shall be taken as equal to 1.5 for components that contain hazardous materials or that are required for life safety to be functional after a seismic event, mapped maximum considered earthquake, 5 percent damped, spectral response at short periods, Ss equals 1.24 g, mapped maximum considered earthquake, 5 percent damped, spectral response at a period of 1 second, S1 equals 0.47, unless specified otherwise.

1.03 DEFINITIONS

A. Backwash or Backpulse: Any instance a membrane train is taken offline and water, and/or chemical solution is pumped through the membranes in the reverse direction of the permeate flow.

B. Days: Defined as calendar days.

C. Design Flow: Equivalent to “Net Flow.”

D. Instantaneous Flux Rate: Equals the permeate flow rate, in gallons per day, produced during the service cycle divided by the total membrane outside surface area in square feet. Service cycle is defined as the period of continuous permeation between the membrane relaxation, backwash or backpulse, where the Seller’s equipment uses relaxation or backwash/ backpulse as a permeability maintenance method. Units of “Instantaneous Flux Rate” are gallons per square foot per day (gfd).

E. Large Membrane Subunit: A group of small membrane subunits sharing a common air and permeate connection. Depending on the Seller, this may be referred to as a “cassette,” “rack,” “unit,” or by other terms.

F. Maintenance Clean: Any instance a membrane train is taken offline for application of a chemical solution that is not considered part of the normal backwash cycle or recovery clean.

G. Membrane Basin: A concrete or steel structure that is hydraulically independent and isolatable and that contains the submerged components of the membrane equipment system.

H. Membrane Tank: One isolatable unit of the overall membrane facility that may contain one or more parallel rows of large membrane subunits. The parallel rows may be separated by a partial wall. The liquid contents in the Membrane Tank shall be hydraulically connected. The Membrane Tank shall be capable of draining and filling as a single entity.

I. Membrane Train: One of multiple functional units of the membrane system that operates in parallel, and distinctly, from other trains, and that includes: a grouping of large membrane subunits located within a single tank, one or more common membrane permeate headers and pumps with one or more membrane permeate pumps per membrane train, one programmable logic controller (PLC), one operator interface unit (OIU), and a common air supply header. A train operates as a single entity for operation, backwash/ backpulsing, relaxing, maintenance, cleaning, or recovery cleaning.

J. Net Flow: Equals the net flow rate of treated effluent (permeate), in million gallons per day (mgd), over a 24-hour period of continuous operation, calculated as flow produced minus backwash and cleaning water, and accounting for periods of relaxation, backwashing, and cleaning.

K. Net Flux Rate: Equals the total amount of permeate produced by the membrane system over a representative period that is available for downstream discharge (after deduction of backwash and cleaning water) divided by the total membrane outside surface area in square feet. Units of "Net Flux Rate" are gfd. Representative period includes relaxation, backpulsing, chemical cleaning, etc., as appropriate for flow duration being considered.

L. NSF: National Sanitation Foundation.

M. Permeability: Equals the instantaneous flux rate divided by the TMP. The units of permeability are gfd/pounds per square inch (psi).

N. Production Capacity: Equivalent to "Net Flow."

O. Recovery Clean: Any manual, automated or semi-automated procedure occurring less than once per month that uses one or more cleaning chemicals to reverse the effects of membrane fouling. This involves isolating a membrane train and filling membrane tank or permeate side of membrane unit fully or partially with cleaning chemicals. The membranes/process components are soaked for a period of time then the spent chemical solution is removed from the train. This process may also be termed "clean-in-place (CIP)."

P. Relaxation: Any instance a membrane train is taken offline by temporarily stopping the permeate pump.

Q. Small Membrane Subunit: Basic unit of membrane production. The small membrane subunit is the smallest assembled unit of a delivered system that is designed to be removed from a large membrane subunit and replaced as a complete unit. Depending on the Seller, this may be a single assemblage of fibers in a common potting attached to a support structure and may be referred to as a "module," "cartridge," or other terms.

R. Temperature Corrected Permeability: Equals permeability multiplied by Seller's Temperature Correction Factor (TCF) expressed in the following form:

$P_{20} = P_t \times TCF^{(20-t)}$

Where:
P_{20} = permeability at 20 degrees C (Celsius)
P_t = permeability at measured temperature in degrees C
t = temperature in degrees C

Unless otherwise provided by Seller, TCF shall be assumed as 1.024.

S. Transmembrane Pressure (TMP): The pressure differential across the membrane. TMP shall be adjusted for losses from membrane discharge to pressure gauge. Units of TMP are pounds per square inch (psi).

1.04 INFORMATION REQUIRED WITH PROPOSAL DOCUMENT

A. See Section 01 30 00, Administrative Requirements, and Section 00 41 63, Proposal Form.

1.05 QUALIFICATIONS AND EXPERIENCE

A. The Seller must meet the following minimum criteria in order to be considered qualified.

1. One membrane bioreactor installation treating municipal wastewater meeting the following criteria:
   a. Reference facility shall use the same membrane (material and hollow fiber) as proposed.
   b. In successful operation for 4 or more years, meeting effluent criteria requirements and flow capacity requirements.
   c. Minimum design annual average flow of 6.1 million gallons (U.S.) per day.
2. Three additional membrane bioreactor installations treating municipal wastewater meeting the following criteria:
   a. Reference facilities shall use the same membrane (material and hollow fiber) as proposed.
   b. In successful operation for 4 or more years, meeting effluent criteria requirements and flow capacity requirements.
   c. Minimum design annual average flow of 2.0 million gallons (U.S.) per day.

3. One additional membrane bioreactor installation in the United States treating municipal wastewater meeting the following criteria:
   a. Reference facility shall use the same membrane (material and hollow fiber) as proposed.
   b. In successful operation for 4 or more years, meeting effluent criteria requirements and flow capacity requirements.
   c. Minimum design annual average flow of 3.0 million gallons (U.S.) per day.
4. Provide information required in the Section 00 41 63, Proposal Form.

1.06 DESIGN DELIVERABLES REQUIRED DURING DESIGN

A. Supplier shall prepare and provide information that documents the design of the system and provide the Engineer with the information necessary to prepare the Contract Documents for the Project.

B. See Section 01 30 00, Administrative Requirements.

1.07 SUBMITTALS REQUIRED DURING CONSTRUCTION (AFTER SCOPE OF SUPPLY IS ASSIGNED TO CONTRACTOR)

A. See Section 01 30 00, Administrative Requirements.

1.08 WORK BY OTHERS

A. The following items are supplied by others:

1. Structural:
   a. Building(s) or cover for housing membrane equipment.
   b. Concrete tankage for membrane trains.
   c. Imbedded wall spools in concrete tank walls for the various process pipe connections.
   d. Covers or grating over membrane trains, including support of covers/grating.
   e. Equipment access platforms, walkways, stairs, etc.
   f. Protective coatings for concrete.
   g. Anchor bolts for membrane equipment.
2. Mechanical:
   a. Permeate piping past the edge of the membrane basin.
   b. Air piping past the edge of the membrane basin.
   c. Pipe supports and hangers, not contained within the membrane basin, unless otherwise noted.
   d. Hoist equipment above the membrane basin for installation and removal of the membrane subunits.

e. Single connection points, unless otherwise noted, for each membrane train for the following:
   1) Permeate header.
   2) Air scour header.
   3) Backwash and cleaning solution supply water.
f. Membrane tank drain piping, if required.
g. Installation materials for instrumentation and automatic valves including, but not limited to, air/sample line tubing, fittings, and mountings.
h. Sludge wasting systems (pipes, valves, pumps).
i. Process aeration blowers.
j. Containment for chemical storage tanks and feed systems
k. Bulk Chemicals for maintenance and recovery cleans.
   1) Sodium hypochlorite (12.5 percent by weight concentration).
   2) Citric acid (50 percent by weight concentration).
   3) Other chemicals as required by Seller.
l. Bulk chemical storage tanks and chemical day tanks.
m. Backwash tank(s), if required.
n. Gates or valves and control elements for mixed liquor influent and effluent.
o. Variable frequency drives (VFDs).
p. Fine screening.

3. Electrical:
   a. Electrical wiring interconnections (including wiring, conduit and other appurtenances required to provide power and control connections as needed) from the electrical power source or control devices to the membrane PLC control panel.
   b. Electrical wiring interconnections (including wiring, conduit and other appurtenances required to provide power connections as needed) from Membrane System PLC or motor control centers to the membrane system motor driven equipment.
   c. Instrumentation and control wiring, conduit and other appurtenances required to provide connections as needed between the terminal of membrane equipment, pumps, instruments etc., and the membrane PLC control panel.
   d. Motor control centers, VFDs, panel boards, transformers, and other equipment necessary to provide power distribution and control for all equipment.
   e. Ethernet communications connection to the Buyer's Plant Control System/SCADA and Membrane Master PLC.
4. Other:
   a. Receiving, unloading and safe storage of equipment at site or a storage facility until ready for installation.
   b. Equipment installation.

c. Raw materials, chemicals and utilities during equipment testing.
d. Laboratory services, operating and maintenance personnel during equipment checkout, startup and operations.
e. Onsite painting or touchup painting of membrane equipment, with the exception of painting required due to damage incurred prior to equipment being received onsite.

1.09 GUARANTEE AND WARRANTY

A. Seller shall provide a guaranteed replacement price, as a cost for each large membrane subunit and as a cost per small subunit.

B. Seller shall warrant and replace the membranes under warranty for a period of 7 years. The warranty shall not be pro-rated. All warrant and support shall be provided directly by the Seller and not the local representative.

C. Seller shall warrant small membrane subunits under the following terms:

1. Seller shall repair, replace, or add at no cost to the Buyer, any small membrane subunits that fail before 7 years from the date of successful completion of the Performance Acceptance Test. Testing and warranty will be applied to each train and each large subunit.
2. Failure is defined as any of the following:
   a. Inability to meet performance requirements as specified herein.
   b. Inability to meet the interval between cleaning cycles for each membrane cleaning strategy used as specified herein.
   c. Inability to meet operating parameters (including flux and cleaning intervals) listed in the proposal.
3. Seller shall further warrant all actuated valves for a minimum period of 2 years after successful completion of the Performance Acceptance Test. The warranty shall not be pro-rated.
4. If Seller is unable to modify the system through addition of membrane subunits and cannot satisfy requirements of Performance Acceptance Test, or if system fails to meet specified performance criteria during 7 years following the date of successful completion of the Performance Acceptance Test, Seller shall be responsible for all costs, including but not limited to labor, professional services, equipment, materials, transportation) needed for complete removal of nonconforming system and subsequent installation of membrane products that meet specified performance conditions.
5. Seller shall provide a cost for a Repair and Replacement Contract which will warrant the membranes for a specified period to commence at the end of year 7 and to continue to the end of year 10 following the date of successful completion of the Performance Acceptance Test. If a membrane fails (as defined above) after 7 years but less than 10 years

following the date of successful completion of the Performance Acceptance Test, Seller shall replace or repair membrane. The annual cost for this warranty, to be paid at the commencement of each year after the seventh year of operation, is to be submitted with the Seller's Proposal. The Repair and Replacement Contract shall cover the replacement of any or all membrane components as required, including the membrane fiber or small membrane subunit.

a. Membrane packing, shipping, and installation costs will be Buyer's responsibility during the term of the membrane repair and replacement period years 8 to 10.

6. All warranties are to be for full cost of repair or replacement, and not pro-rated.

D. Seller shall guarantee that, for components manufactured by the Seller, replacement parts shall continue to be available to the Buyer for a minimum of 20 years from date of successful completion of Performance Acceptance Test. Seller shall guarantee that, if Seller or Seller's product line is sold, Seller shall make provisions such that all guarantees, warranties, and bonds will remain in effect and that replacement parts and operational support continue to be available to the Buyer for the time period specified above.

E. Seller shall warrant all other equipment, not specifically mentioned above, against defects in workmanship and materials for a period of 2 years. The warranty period shall begin following completion of the Performance Acceptance Test as specified herein.

F. Seller shall make all repairs or replacements necessitated by defects in materials or workmanship that become evident within the warranty period. The repair or replacement shall start not later than 10 days after Buyer notifies the Seller and shall be completed to Buyer's satisfaction not later than 30 days after the notification to the Seller was first issued.

G. Seller also agrees to hold the Buyer harmless from liability of any kind arising from damage due to defects of equipment/system supplied by Seller. Seller shall make all repairs and replacements promptly upon receipt of written orders for same from the Buyer. If within 10 days after the Buyer has notified Seller of a defect, Seller has not started to make the necessary corrections, or has not completed the corrections to Buyer's satisfaction within 30 days after Buyer has notified seller of a defect. The Buyer is hereby authorized to make the corrections or to order the Work to be done by a third party, and the cost of the corrections shall be paid by Seller and warranty remains in effect.

H. Any material and equipment that fails (as defined above) more than twice or cannot be restored to meet the design capacity and performance by chemical cleaning and backwashing within 30 days of the date Buyer first notifies Seller of the failure shall be cause for material and equipment replacement and

an extension of the warranty period for the specific component(s) to a date 2 years following acceptable replacement.

I. Propose, for the Buyer's approval, the tests and procedures required to continue the warranty and repair and replacement contract conditions following the exceedance of a warranty or contract condition, such as flow in excess of contract conditions occurring over a certain time duration. Provide data to substantiate the relevance of each parameter including the significance and percentage impact of any parameter not within the desired range.

1.10 SPARE PARTS AND SPECIAL TOOLS

A. Procedures for Shipment: Per Section 01 61 01, Product Requirements.

B. Provide the following spare parts, at a minimum, in addition to manufacturer's standard spare parts and recommended special tools:

1. One set of expendable materials such as gaskets, seals, and packing.
2. One set of new and unused special tools required for installation, operation, and maintenance per each type of equipment or system.
3. One repair kit for sealing off damaged membrane fibers within the small membrane subunit sufficient to repair up to 5 percent of the supplied membranes.
4. One complete set of all jigs, fixtures, clamps, lifting beams, hooks, and other instruments required facilitating the removal, disassembly, re-assembly, and installation of each item of equipment within the system.
5. Reagents/chemicals, calibration sets, and spare parts as specified for individual equipment items or instruments.
6. Spare parts for instruments, PLC hardware and control devices as specified in Section 40 99 90, Package Control Systems.
7. Extra materials for related equipment as specified in Section 43 12 01, Compressed Air Systems, Section 44 42 19.04, Rotary Positive Displacement Blower, and Section 44 42 56.10, Horizontal End Suction Centrifugal Pumps.
8. One shelf spare permeate pump, each size.
9. One shelf spare for each type of meter (flow, level, etc.), pressure gauge, pressure differential transmitter, valve and actuator supplied under this Contract.
10. Any additional special tools and spare parts recommended for the first year of operation.

C. Guarantee availability of manufacturer's standard spare parts, those required above, and recommended special tools for a period no less than 20 years.

PART 2 PRODUCTS

2.01 GENERAL

A. Membrane equipment shall be provided complete, with all necessary components, accessories and appurtenances required to make a complete and operable system. Interconnecting piping between membrane trains and ancillary systems, including air scour blowers, shall be provided by others.

B. Membrane subunits and equipment shall be prefabricated, preassembled, and factory tested before shipment to the Site.

C. Membrane product shall be compliant with the current California Department of Public Health Services (CDPH) recycled water regulations.

D. Seller shall provide the Equipment as described in these Specifications:

1. Equipment shall be new and unused and shall be Seller's most current product line at the time of product submittal (Design Deliverable No. 1, as scheduled in Section 01 29 00, Measurement and Payment).
2. Equipment shall be designed to use latest generation membrane subunits having greater membrane area or improved performance characteristics with CDPH Title 22 certification, or already tested and on track for approval within 6 months from April 2017.
3. Equipment shall be furnished as a complete, operable, and maintainable system including all instruments, devices, valves, and actuators.
4. Equipment shall fully comply with the strictest of the California and Federal OSHA standards.

E. All components of the Membrane Equipment System shall be fully automated as described in the Contract Documents as the system may be unstaffed for the majority of time. Recovery cleaning operations shall be automated, but may be operator initiated.

F. All components of the Membrane Equipment System shall be tagged to conform with Engineer's tag numbering convention. Where applicable, use Engineer provided tag numbers as shown on Drawings and listed in Specifications.

2.02 SERVICE CONDITIONS

A. San Luis Obispo WRRF will provide biological treatment for medium strength municipal wastewater.

B. Influent wastewater will be screened using the screen type, opening size, and configuration required by the Seller in Section 00 41 63, Proposal Form. No bypass of the screens will be permitted in any direction. The fine screens will be preceded by a primary clarifier preceded by a conventional grit removal system. Screening system shall be provided by others. A portion of the primary sludge may be reintroduced into primary effluent upstream of the fine screens.

C. Biological reactor zones will be provided upstream of the Membrane Equipment System, and furnished by others. The Membrane Equipment System will provide filtration for mixed liquor from a biological wastewater treatment process.

D. The Membrane Equipment System performance requirements specified herein shall be met when mixed liquor characteristics comply with the following:

1. Wastewater Temperature: 16 degrees C to 27 degrees C.
2. Mixed Liquor Suspended Solids (MLSS) Concentration Leaving the Membrane Basin: 5,000 mg/L to 12,000 mg/L (daily average).
3. Biomass Solids Retention Time (SRT): 10 days to 22 days. The biological treatment system is designed to maintain nitrification, evidenced by effluent ammonia nitrogen less than 1 mg/L, and effluent nitrate nitrogen less than 10 mg/L. Supplemental carbon may be added to primary effluent for denitrification.
4. Alkalinity: Greater than or equal to 50 mg/L. Effluent pH range goal is 7.0 to 8.3. Calcium hydroxide is added to primary effluent for alkalinity and pH control.
5. Ferric chloride and polymer may be applied upstream of primary clarifiers during high flow conditions.

E. Membrane Basin Configuration:

1. Membrane basins will be constructed by others. The number of membrane tanks, membrane trains, and number of large membrane subunits within each basin to be provided and the equipment to be installed shall be recommended by the Seller. There shall be a minimum of five membrane trains.
2. It is intended that all membrane trains will be in service at full capacity under normal operating conditions. However, the Membrane Equipment System shall be capable of meeting all performance requirements stated herein and under Maximum Equalized Flow (MEF) design conditions with one membrane train out of service.
3. Membrane Equipment System must be able to be operated at reduced capacity for extended periods of time.

4. Each membrane train will be equipped with one or more dedicated permeate pumps.

F. Ground Surface Elevation: Refer to Section 01 61 01, Product Requirements.

G. Membrane pumping equipment may be located outdoors under cover. Air scour blowers and compressors will be located indoors.

2.03 PERFORMANCE REQUIREMENTS

A. Membrane Equipment System Design Production Capacity:

Condition	Duration	Flow*
Annual Average Daily Flow (AADF)	365 consecutive days	6.3 mgd
Minimum Month Average Day Flow (MinMADF)	30 consecutive days	2.3 mgd
Maximum Month Average Day Flow (MMADF)	30 consecutive days	8.6 mgd
Maximum Week Average Day Flow (MWF)	7 consecutive days	11.6 mgd
Maximum Equalized Flow (MEF)	4 consecutive days	13.2 mgd
Peak 2-Hour Flow (PHF)	2 hour	16.0 mgd

mgd = Million Gallons (U.S.) per day

*Includes 0.2 mgd internal plant recycles. Does not include recycles required by the membrane system.

B. Raw wastewater flow to the WRRF is expected to follow normal diurnal wastewater flow patterns.

1. Coordinate permeate production with the downstream UV disinfection process (provided by Others).
2. Permeate flow to the UV disinfection process must be continuous for flows down to 1.0 Million Gallons (U.S.) per day. Pauses in permeate production which result in all UV banks turning off are not acceptable.
3. Influent diurnal minimum flows may be as low as 0.5 Million Gallons (U.S.) per day. Permeate flow may be intermittent for influent flows less than 1.0 Million Gallons (U.S.) per day.
4. Raw wastewater flow will be equalized only during wet weather conditions. The MEF condition will not experience diurnal flow variation for the specified duration.

C. The supplied membrane equipment system shall meet all of the membrane permeate quality requirements in Paragraph Membrane Permeate Quality, and operate at normal operating parameters and conditions at the MEF production capacity in Paragraph Membrane Equipment System Design Production Capacity, with one membrane tank or with one membrane train permanently out of service. The out of service membrane train may not be used for anticipated membrane cleaning during this flow condition.

D. The Seller shall determine the required membrane surface area to meet the performance requirements and warranty provisions, and provide the membrane tank dimensions for each membrane train, including required clearance between the tank inlet and membrane subunits and between membrane subunits and tank outlet. Include provision to increase membrane surface area by 10 percent within each basin by adding additional large or small membrane subunits. The Buyer may elect to provide additional volume for its own use. During the course of the design, initial operation, warranty period, or during the course of the repair and replacement contract, if the Seller determines that additional volume is required, Seller shall pay all costs for constructing the additional volume, as described in Section 00 52 63, Agreement Form.

E. Design production capacity shall be based on membrane permeate production, verified by the Buyer and the Engineer, during the Performance Acceptance Test and Commissioning, and during the subsequent 7 year membrane guarantee and warranty period. Compliance is required for each membrane train. The Seller to Buyer's satisfaction, at no additional cost to the Buyer, is responsible for modifying the system during startup and within warranty period to achieve design production capacity if testing of membrane system fails to meet the design production capacity.

F. Membrane Permeate Quality:

1. Membrane permeate shall meet the CDPH Title 22 requirements and following upon sampling, which may occur at any time:
    a. Turbidity: Shall not exceed 0.2 NTU more than 5 percent of the time within a 24-hour period and shall not exceed 0.5 NTU at any time.
    b. Total Suspended Solids (TSS): Less than or equal to 1 mg/L on 9 of 10 consecutive samples and no sample shall exceed 2 mg/L.

G. Membrane Cleaning:

1. Membrane subunits shall be cleaned in place using backwash, chemical solutions or relaxation to meet production capacity and other performance requirements specified herein.
2. Maintenance cleans shall not be performed more frequently than twice per week per chemical.

3. Recovery cleans shall not be performed more frequently than once every 90 days.
4. Identify a chemical substitute for hypochlorite which the Buyer may use at their option.

H. Polymer Addition: Seller shall not be permitted to add polymer to increase operating flux or for any other performance improvements.

2.04 MEMBRANE EQUIPMENT SYSTEM COMPONENTS

A. Membrane Material:

1. Membrane product shall be compliant with the California Department of Public Health Services (CDPH) recycled water regulations. Provide documentation for the certification or approval by CDPH for Title 22 compliance of the membrane product in a MBR application.
2. Use hollow-fibers having a nominal pore size of 0.4 micron or less.
3. Flow from the outside to the inside of the fiber.
4. Membranes shall be constructed of chemically resistant materials as required for stipulated range of operating and maintenance conditions. Membranes shall be capable of being washed in high chlorine solutions (minimum 1,000 mg/L), and low pH (range 2 to 3) and high pH wash solutions (range 10 to 11). Membranes shall be suitable for use with a chemical substitute for hypochlorite.
5. Membranes shall be physically strong enough to withstand the operating conditions associated with continuous operation in an aerated tank of mixed liquor at concentrations of up to 15,000 mg/L.
6. For systems which use backpulsing, membranes shall be able to withstand backwash flow (from inside to outside) as proposed by Seller, without any damage.

B. Small Membrane Subunits:

1. The membranes shall be assembled into a housing called a small membrane subunit.
2. The small membrane subunit shall be constructed such that the membranes are held vertically and bonded firmly at the top and/or bottom of the subunit.
3. The internal lumens of the membrane fibers shall connect into a common area at the top and/or bottom of each small subunit.
4. The materials used to hold the membrane fibers in-place shall be chemical resistant to high concentrations of chlorine (minimum 1,000 mg/L), and low pH (range 2 to 3) and high pH wash solutions (range 10 to 11).

5. The top and bottom sections of the small membrane subunit shall be connected with corrosion resistant materials and allow permeate to be withdrawn from one or both ends of each small membrane subunit.
6. The base of each small membrane subunit shall use diffusers to allow scour air to escape and travel upwards past and between the membrane fibers, creating an agitation effect.
7. All nonsteel components of the small membrane subunits shall be UV resistant and have a chemical resistance at least equal to that of the membranes.

C. Large Membrane Subunit:

1. The small membrane subunits shall be assembled into large membrane subunits.
2. Each large membrane subunit shall be supported within a frame or support rails manufactured of chemically resistant Type 316L stainless steel materials or other materials provided the proposed assembly has been successfully used by the Seller for at least 2 years.
3. Provide a complete support system for installation in concrete basin, consisting of beams, frames, and brackets. Anchor bolts shall be furnished by others.
4. Provide isolation valves on permeate and air scour, and any other process piping within limits of membrane basin to provide means of isolating and removing individual large membrane subunits from the remainder of system, without draining the train, and to enable the system to produce permeate with one or more large subunits out of service.
5. Fit each frame with two lifting eyes (one at each end) to allow the entire large membrane subunit to be lifted into and out of the membrane train and transported away. A lifting bracket that connects to the frame at multiple points and is lifted at one point is also acceptable.
6. All fasteners, including nuts, bolts, screws, cables, washers and other appurtenances, associated with the large membrane subunit and housing shall be manufactured from Type 316 stainless steel. Seller shall ensure that sufficient isolation is provided such that no galvanic corrosion occurs between fasteners and the frame/support rails.

D. Permeate Pumping System:

1. Permeate Suction Piping:
   a. Each membrane train shall have a suction header for permeate collection. The header shall have a connection for a pressure/ vacuum gauge at each end.
   b. All large membrane subunits in a membrane train shall be connected to the suction header.

c. The pipe connections between the large membrane subunits and the manifold header pipe work shall be capable of operating at the positive and negative pressures expected for this system.

2. Permeate Pumps:
   a. Pumps shall be horizontal end-suction centrifugal in accordance with Section 44 42 56.10, Horizontal End Suction Centrifugal Pumps, or rotary lobe pumps in accordance with Section 44 42 56.14, Lobe Pumps.
   b. Quantity: One or more per membrane train and as required in Article Spare Parts and Special Tools.
   c. Rated Capacity: Rated capacity shall be based on pumping the peak 2-hour flow with all trains in service, and shall be capable of pumping the MEF with one membrane train or with one membrane basin out of service. The amount of permeate water used for membrane cleaning shall be taken into account when determining the rated capacity of the permeate pumps.
   d. In addition to the production capacity requirements, the permeate pump shall deliver sufficient additional total dynamic head of 4 psig. System losses will be confirmed as design progresses.
   e. Coordinate permeate pump system with relaxation and backwash/backpulse schedule to provide continuous flow of permeate to downstream UV disinfection process. Minimize flow variation to UV disinfection.

E. Air Extraction System (if required):

1. An air extraction system shall be provided to remove air bubbles generated during the permeate extraction process.
2. The system shall consist of an eductor mounted to the high point of permeate piping system, level sensors, and control valves unless otherwise required by Seller. Eductor may utilize instrument air or plant water. Air extraction systems that rely upon vacuum pumping are unacceptable.
3. Air Separation Column (If Required):
   a. Seller shall size column to provide adequate residence time to ensure satisfactory air removal from the permeate.
   b. Column shall be Type 316 stainless steel.
   c. Provide one column per membrane train.
   d. The air outlet of the air separation column eductors and/or control valves shall be connected to a drain with piping provided by others.
   e. Each air separation column shall be equipped with a level sensor. Apart from normal operating control loops, the level sensor will include a Level-Alarm-Low level. Should the liquid level in the vessel drop to this level, an alarm will be generated.

F. High Pressure Compressed Air System (If Required):

1. Instrument air to operate eductors, pneumatic valves and instrumentation of the Seller's equipment package shall be provided by the Seller.
2. Compressed air system shall include reciprocating compressors, desiccant dryers, air receivers, piping, and appurtenances in accordance with Section 43 12 01, Compressed Air Systems.

G. Cleaning Systems:

1. Air Scour System:
   a. Provide air scour blower system including blowers, controls, valves, inlet filters, check valves, pressure gauges, discharge pressure safety valves, low flow switches, and high pressure switches as required by Seller for control of fouling and to assist in keeping the mixed liquor in a membrane basin in suspension.
   b. Blowers shall be positive displacement type in accordance with Section 44 42 19.04, Rotary Positive Displacement Blower. Size blowers for water surface depth at top of membrane tank wall. Provide one of the following configurations:
      1) Dedicated Blower: Each train has a dedicated blower. Provide a minimum of one shelf spare blower.
      2) Common Header: Provide a minimum of two duty blowers and one standby blower with all membrane trains in service. Provide control and measurement of flow to each individual train.
   c. Air cycling valves and actuators, if required for control and operation of the air scour to each membrane subunit, shall be provided by Seller.
   d. Provide air distribution header(s) and diffusers for each membrane train within limits of the membrane basin.
2. Backwash or Backpulse System (If Required):
   a. Provide backwash pumps, isolation valves, check valves, chemical injection connection and mixing systems, flow meters, instrumentation and controls, and other components to provide an automated backwash system.
   b. Backwash water source shall be the permeate produced from the system.
   c. Provide a standby pump or equivalent operational redundancy.

3. Maintenance and Recovery Cleaning Systems:
    a. Provide all pumps, controls and connection points, mixing devices, valves, chemical injection points, and other system components to provide the chemical cleaning system for each membrane train:
        1) Skid mount chemical metering pumps, valves and operators, flow meters, instrumentation and controls, and appurtenances for a complete operable chemical feed system. Include calibration columns. Provide all piping within each skid unit.
        2) Provide a standby pump for each chemical system.
        3) Clearly identify whether large membrane subunits must be isolated from the membrane train for any or all cleaning operations.
    b. Maintenance Clean System (if applicable): Designed to maintain design production capacity by reducing TMP and increasing permeability by oxidizing or solubilizing biological and nonbiological matter within the membrane surface and in the membrane pores.
    c. Recovery Clean System:
        1) Designed to remove solids that have accumulated in membrane modules (including on membrane surface and within membrane pores) so that the design permeate production capacity and the temperature corrected permeability directly following the cleaning are consistently restored to minimum values as specified in Article Performance Requirements.
        2) Provide Basin Drain Pumps if recovery clean requires membrane tank to be drained of mixed liquor.
4. Basin Drain Pumps:
    a. Provide basin drain pumps, isolation valves, check valves, flow meters, instrumentation and controls, and other components to provide an automated basin draining system, if required.
    b. Drain pumps shall pump the basin contents to the return activated sludge channel.
    c. Initiation of basin draining, and all functions of backwash system shall be automatically controlled by the Seller’s PLCs. Draining shall be automatically initiated based on cleaning cycle requirements.

H. Membrane Integrity Test System:

1. Provide continuous turbidity monitoring and alarm system on each train to identify loss of membrane integrity.
2. Provide the method and means to identify the large membrane subunit, small membrane subunit, and individual fibers with loss of membrane integrity.

2.05 PIPING AND VALVES

A. Seller's scope of piping supply shall be within the limits of the membrane basin and skid mounted chemical systems.

B. Seller shall provide permeate headers, air headers, and any other piping required to connect the large membrane subunits to the headers.

C. Seller's scope of valve supply shall include those within the limits of the membrane basin and isolation valves, check valves, control valves, and other required valves outside of the membrane basin for the following systems:

1. Permeate Pumping System.
2. Air Extraction System.
3. High Pressure Compressed Air System (if required).
4. Cleaning Systems.
5. Membrane Integrity System.
6. As specified.

D. Terminal point connections shall be ANSI standard flanges.

E. Piping shall be in accordance with Section 40 27 00, Process Piping—General:

1. Install true union fittings where future disconnection may be required.
2. Permeate piping shall be designed to limit maximum flow velocities to 8 feet per second (fps). If unable to meet 8 fps flow criteria, Seller shall indicate and describe locations where velocities exceed this limit and rationale as to why they cannot meet the flow criteria.
3. Process air piping shall be designed to limit maximum flow velocities to 3,800 feet per minute (fpm). If unable to meet 3,800 fpm flow criteria, Seller shall indicate and describe locations where velocities exceed this limit and rationale as to why they cannot meet the flow criteria.

F. Valves shall be in accordance with Section 40 27 02, Process Valves and Operators.

1. Provide all valves required for a completely functional system (shipped loose) within the limits of the membrane basin and for those systems outside the limits of the membrane basin described in Article Piping and Valves.
2. Provide valves suitable for intended service and relevant chemical exposure.
3. Provide valves to isolate each large membrane subunit. Use of quick-connect caps on the connections to a removed unit is also acceptable.

G. Actuators shall be in accordance with Section 40 27 02, Process Valves and Operators:

1. Electric Actuators: Use for typical OPEN/CLOSE application except as noted below.
2. Pneumatic Actuators: Use for OPEN/CLOSE application where fast action is required.
3. Both electric and pneumatic actuators shall have LOCAL and REMOTE control features. Where integral controls on the actuators are not provided or not accessible, provide Local Controls Stations (LCS) remote from the actuator.

2.06 ELECTRICAL

A. Electrical components shall be provided in accordance with Section 26 05 01, Electrical.

B. Three-phase, 480V ac power shall be available at the Project Site.

C. Prepiped and skid mounted components shall be prewired to a terminal junction box located on the skid.

D. Electrical material and equipment shall have UL listing wherever standards have been established by that agency.

E. Complete electrical assembly shall meet all requirements of the National Electrical Code, the National Electrical Manufactures Association (NEMA), the National Fire Protection Association (NFPA), and all applicable state and local codes.

2.07 CONTROL SYSTEM

A. All control panels and enclosures shall be in conformance with Section 40 99 90, Package Control Systems, requirements.

B. General: Provide control panels, PLC and Operator Interface Unit (OIU) hardware and software, data transfer and graphic emulation support, Membrane Control System software package, data links with the Buyer's Plant Control system, graphic display and configuration, and instruments. Instrumentation and control components shall be in accordance with Section 40 99 90, Package Control Systems.

C. For software, provide narrative description of process control systems and overall control system, loop diagrams, summary of control functions, summary of monitoring functions, descriptions of alarms, and other information to describe the control system. Identify specific logic components to be programmed into each PLC.

D. Provide and program PLC and Operator Interface software to control the operation of the Membrane Equipment System.

1. Provide and configure PLCs and OIUs per the requirements specified herein and also to support a safely operating system.
2. Provide and design PLC system so that a maximum of one train may be removed from service at a time.
3. PLC I/O signals will be distributed across I/O modules to ensure that a single module failure will not eliminate key functionality required for the MBR system. PLC I/O for membrane trains will be distributed accordingly.
4. The PLCs shall communicate with the Plant Control System via Ethernet network. The Plant Control System shall monitor and provide supervisory control of the MBR PLC system. This is in addition to concurrent monitoring and control by each local Operator Interface furnished by the Seller. See below for more details.
5. Upon loss of communication between the Plant Control System and the Membrane Control System, each train shall continue to operate using, as a minimum, the current permeate flow set point and, preferably, a fully-functional flow control algorithm such as one based on liquid level in the bioreactor basin.
6. Provide graphical displays to monitor and control all aspects of Membrane Equipment System.
7. Refer to Section 40 91 00, Instrumentation and Control Components, for additional requirements.
8. Refer to Section 40 99 90, Package Control Systems, for additional requirements.

E. PLC Configuration:

1. PLC Architecture: Provide one spare PLC; fully programmed with PLC program; as accepted by the Buyer. The PLC shall be the same make and model as the one furnished for the Project. Furnish an additional PLC (as described above) for each type of PLC on the Project.
2. Provide redundant Large-Package PLC, per Section 40 99 90, Package Control Systems, for the membrane system Master PLC.
    a. Each PLC controller shall have enough data memory to store twice the amount of tag data that is associated with a redundant controller project, plus an additional 25 percent spare capacity.
    b. Train PLCs shall follow either Large-Package PLC or Small-Package PLC, per Section 40 99 90, Package Control Systems. Vendor may opt to not provide Train PLCs and use Remote I/O per train. Remote I/O will follow Large-Package PLC standard.
    c. Connect remote train PLCs via Ethernet/IP Device Level Ring network. Implement this network independent from the Ethernet/IP network for connection to the Plant Control System. Seller will work with Engineer to ensure fiber optic ring topology is dedicated for this PLC communication.
    d. OIU Supplier and Product: Provide OIU at the Master PLC panel to meet the function description and to interface with the Plant Control System. Refer to Section 40 99 90, Package Control Systems, for additional requirements.
3. All motor control starters and VFDs shall be connected to the Master PLC panel via Ethernet/IP Device Level Ring topology. Seller will provide separate and isolated network components for motor control and monitoring. There will be no direct connection between the network to Plant Control System and the motor control network.
    a. Contractor shall provide motor control starters and VFDs consistent with plant standards. Seller shall coordinate with contractor to create a working motor control network.
4. Equipment and components associated with each membrane train shall be controlled by a sufficient number of PLCs, communication and I/O modules such that the failure of any one component shall not reduce membrane system capacity or functionality.
5. Provide all PLCs, chassis and I/O modules as required to support the Membrane Bio-Reactor (MBR) system plus a minimum of 20 percent spare. All I/O shall be wired to field terminations, isolation and interposing relays for discrete inputs and outputs.
6. Equipment servicing more than one membrane train, such as backpulse pumps and air compressors, shall have their controls distributed among the Master PLC I/O modules. Assign one equipment unit to a PLC chassis, e.g., one backpulse pump to a PLC chassis such that failure of a PLC module shall affect only one equipment unit in a parallel set of equipment items.

7. Control functions required to coordinate the operation of individual membrane trains shall be implemented in a Master PLC with redundant processors. Examples of master control functions include:
   a. Allocation of flow set points to each membrane train.
   b. Coordinating backwash of each membrane train.
   c. Coordinating chemical cleaning of each membrane train.
8. The redundant master PLC processors shall function as “hot backups” such that on failure of the active processor, the control functions shall automatically continue to be performed by the backup redundant processor.
9. All information displayed on the MBR Master PLC panel OIU shall be communicated via Ethernet/IP to the plant SCADA system.

F. Coordination and Data Integration with Plant Control System.

1. The Plant Control System uses GE iFix application software. This software will be provided outside the scope of the Seller, but will be used as the Plant Control System interface to the membrane system and Master PLC.
2. Complete operation of each membrane train shall be possible at the OIU at each train or at the Plant Control System/SCADA HMI graphical screen. The Seller shall assist the Contractor in programming the SCADA HMI computer. Provide for Buyer and Engineer input into graphics, displays, etc.
3. In addition to the Membrane System Operator Interface Units, the treatment process shall have the ability to be operated and monitored from the Main Control Room via the Plant Control System network. Seller shall provide all program files for the PLCs and Operator Interface Units at the completion of the project. Seller shall also provide the graphics files and memory maps of all registers for control and monitoring of the Membrane Equipment System such that the Buyer's Control System Integrator can configure the Plant Control System HMI (Human-Machine-Interface).
4. See also requirements in Section 40 99 90, Package Control Systems.

G. All controls and monitoring shall be accessible by the Plant Control System via the Ethernet network. Provide means for data exchange with Plant Control System as specified.

H. Both 120V “normal” power and 120V UPS backed power shall be provided to the Membrane System PLC by Others.

I. Functional Description: The Membrane Control System shall be designed to perform the following functions as a minimum:

1. General:
   a. Communicate all data to the Plant Control System for monitoring, control, alarming, historical storage (historical trends, alarm logs, operating data, cleaning and backwash information).
   b. Provide other features as required by system for unattended operation, unattended startup, and to meet specified performance requirements.
2. Permeate System:
   a. Monitor operational data for permeate and other membrane system components including the following at a minimum:
      1) Transmembrane (vacuum) pressure while permeating.
      2) Transmembrane pressure while backpulsing (if applicable).
      3) Permeate production rate per train.
      4) Total (system) permeate production rate.
      5) Hours of operation for each permeate pump/train.
      6) Permeate temperature for combined permeate flow.
      7) Permeate turbidity for each train.
      8) Perform calculations of permeability and temperature corrected permeability for each train and plot both parameters as a function of run time.
   b. Provide trend displays for each train showing the most recent operational data at the current 24-hour flow, 7-day flow, and 30-day flow.
   c. Permeate Pumps:
      1) START/STOP and flow control of permeate pumps.
      2) Adjust total permeate production rate through membrane train in response to Total Bioreactor Influent flow and adjusted to maintain an Aerobic Bioreactor Effluent Channel level set point.
      3) Provide individual permeate pump flow set points based on Total Permeate Production Rate and number of membrane trains in service.
   d. Air Scour:
      1) Determine the air scour flow required for membrane operations and communicate the total agitation air flow required to the Plant Control System.
      2) The PLC shall control the air scour blowers based on the required air scour flow and pressure.

e. Membrane Basin Level:
   1) Provide level transmitters for each membrane train.
   2) Receive level signals for each membrane train for monitoring and control.

3. Cleaning Systems:
   a. General:
      1) PLC shall control sequence of backwashing and chemical cleanings.
      2) Record backwashes, air and water backwash duration, backwash flow, and perform calculations to determine permeate production rate.
      3) The Seller shall supply the control functions for the cleaning cycles. When Seller's cleaning sequence requires chemical pump to operate, a signal shall be sent to start the pump. Similarly, when Seller's cleaning sequence requires chemical pump to stop, a signal shall be sent to stop the pump.
      4) All chemical cleaning systems shall be fully automated and shall not require manual operation of any equipment or valves.
   b. Total air scour flow rate shall be monitored and controlled by the Seller's PLC.
   c. Backwash or Backpulse (If Required): The Backwash System shall perform the Backwash Function automatically at operator-entered time intervals, TMP, or per manual initiation by operator.
   d. Maintenance Clean System:
      1) Designed for automatic operation controlled by the PLCs.
      2) Shall be automatically initiated based on time or an operator-entered number of backwashes/backpulses. System shall also allow operator to initiate a maintenance clean manually.
   e. Recovery Clean System:
      1) Designed for automatic operation once a cleaning cycle has been initiated by the operator.
      2) Sequence shall permit an operator-initiated recovery clean abort in which the system will automatically stop the cleaning sequence and start the membrane trains.
      3) Seller's PLC shall send control signals to Plant Control System for control of drain valves, tank isolation gates, etc.

4. Alarms:
    a. As a minimum, provide alarms for each train for high TMP, high permeate turbidity, low permeate flow, low agitation air flow, all high and low level alarms, and permeate pump failure. Alarms shall also be sent to the Plant Control System.
    b. Shutdown train, and alarm upon high TMP, turbidity above 0.5 NTU, and failure of any defined critical parameter or component.
    c. Record and alarm power failures.
    d. Provide listing of all alarm events and all other events that could cause a membrane train to shutdown or to be placed into standby or shutdown or any other nonproducing state.
5. Control Interface with Plant Control System: Make available and receive in contiguous PLC data registers the following data to and from the Plant Control System:
    a. Output Data to the Plant Control System:
        1) Status of each piece of equipment.
        2) Hours of equipment/train operation.
        3) Alarms.
        4) Process variable values.
        5) Control set points and control commands (START/STOP, OPEN/CLOSE) for equipment controlled by the Plant Control System.
    b. Input Data from the Plant Control System:
        1) Process variable values monitored by the Plant Control System.
        2) Operator entered values (e.g., set points), control actions (e.g., START/STOP), and operator selections (e.g., AUTO/MANUAL) same as provided at the Operator Interface Units.
        3) Equipment status feedback for equipment controlled by the Plant Control System.
6. Miscellaneous SCADA Monitoring Points: Include in the package control system the following points to be monitored and transferred to the SCADA system via the PLC.
    a. Utility Power On.
    b. Power Supplies OK.
    c. Ethernet Switch Fault.
    d. Panel Intrusion.

2.08 INSTRUMENTATION

A. General Requirements: Provide instrumentation described herein in accordance with Section 40 91 00, Instrumentation and Control Components. All transmitters with displays or tuning/programming controls shall be mounted for easy access at heights between 42 inches and 54 inches above floor. All instruments shall be mounted such that they are protected from damage such as can be caused by vibrations from pulsing flow. Where the Seller's scope of supply includes certain sub-systems as stated elsewhere in the Contract Documents, the Seller shall provide all instruments associated with the sub-system.

B. All instrumentation shall include HART-enabled electronics/transmitters, except where noted in Section 40 91 00, Instrumentation and Control Components.

C. Turbidity Elements and Transmitters:

1. Function: Continuously measures, indicate, and transmit signals proportional to turbidity of permeate from each membrane train. Range: Provide turbidity elements and transmitters capable of measuring 0 NTU to 10 NTU.

D. Total Suspended Solids Elements and Transmitters:

1. Function: Continuously measures, indicate, and transmit signals proportional to suspended solids of permeate from each membrane train.
2. Range: Provide suspended solids elements and transmitters capable of measuring 0.001 mg/L to 50,000 mg/L.

E. Magnetic Flow Meters:

1. Function: Continuously measures, indicate, and transmit signals proportional to flow of membrane permeate and membrane backwash for each train.

F. Thermal Mass Flow Meters:

1. Function: Continuously measures, indicate, and transmit signals proportional to air flow of air scour system to each train.

G. Pressure Differential Transmitter:

1. Function: Continuously measures, indicate, and transmit signals proportional to differential pressure of membranes for each train.

H. Pressure Transmitter:

1. Function: Continuously measures, indicate, and transmit signals proportional to pressure of membranes for each train.

I. Temperature Transmitter:

1. Function: Continuously measures, indicate, and transmit signals proportional to temperature of permeate discharge for each train.

J. Float Level Switches:

1. Function: Provide in each membrane train for low level alarms and shutdown.

K. Level Transmitters:

1. Function: Provide noncontact level measurement in each membrane train. Technology used for level measurement shall be submitted by the Seller, but shall include relay outputs for HIGH and LOW levels.

PART 3 EXECUTION

3.01 SERVICES DURING DESIGN

A. Seller shall provide equipment layout support services as outlined in Section 01 30 00, Administrative Requirements.

B. Seller shall assist the Buyer and Engineer by reviewing and evaluating site, structure, piping, and equipment layouts; interfaces with other processes and facilities; and other components to develop a design that best serves the Buyer.

C. Seller shall review the Engineer's Contract Documents and Specifications for construction of the San Luis Obispo WRRF Membrane Equipment System facilities. Seller shall submit review comments to the Engineer within 14 calendar days of receipt of the review submittal concerning whether the Design Drawings and Specifications are consistent with the Seller's scope of work and are appropriate for proposing and construction of facilities related to the installation, startup, and testing of the Seller's Membrane Equipment System. Seller shall provide input to the Engineer for revision of the Design Drawings and Specifications, if needed to accommodate Seller's Membrane Equipment System.

D. Seller shall assist in answering questions received from the Engineer and from proposers during advertisement of the construction contract.

E. Design Workshops and Submittals:

1. Seller shall assist in the development of the final design through a series of workshops and submittals listed below:
   a. System Integration Workshop (Including Proposal review, system integration review, PLC and SCADA and data integration concepts).
   b. Design Deliverable No. 1.
   c. Submittal Review and Coordination Workshop No. 1.
   d. Design Deliverable No. 2.
   e. Submittal Review and Coordination Workshop No. 2.
   f. Design Deliverable No. 3 (Final Design Submittal).
2. Seller shall prepare and submit detailed equipment submittals that document the design of the system and provide the Engineer with the information necessary to prepare the construction documents in accordance with the procedures detailed in Section 01 30 00, Administrative Requirements.
3. Submittals provided with the Seller's Proposal will be used to initiate the design process at the System Integration Workshop.
4. Seller shall provide the services of at least two qualified representatives at each workshop, one representative must be employed by the Seller.
5. The System Integration Workshop shall be 3 full days (exclusive of travel time). Other Workshops shall be 1 full day (exclusive of travel time). All Workshops will be held at the office of the Engineer.

F. System Integration Workshop: Within 10 days after contract execution, Seller shall conduct a System Integration Workshop with Engineer to:

1. Review Proposal Submittals: Resolve intent and provide clarifications. This will include discussion of mechanical equipment and layout.
2. Review PLC and Digital System Block Diagram: Confirm no single point of failure, functionality, etc.
3. Review PLC Programming Orientation: What is performed in PLCs, and where are access points for train-specific and shared I/Os.
4. Review draft process control narratives.
5. Review alarms, power failure scenarios, and any events or alarms that cause a train to shut down.
6. Identify details of air flow and vacuum flow requirements, including flows, durations, pressure, and variation.
7. Review approach to HMI graphical emulation and control.
8. Review data transfers required to perform graphical emulations and control.

G. Submittal Review and Coordination Workshops: Within 5 days after submission of Design Deliverable, Seller shall conduct a workshop to receive and comments.

3.02 FACTORY INSPECTION AND TESTING

A. Refer to Section 40 99 90, Package Control Systems, for additional Factory Testing requirements.

B. Factory Inspections: Inspect equipment and control panels for required construction, electrical connection, and intended function.

C. Factory Tests and Adjustments:

1. Test equipment and control panels actually furnished.
2. Provide written certification of tests to Engineer prior to shipping equipment.
3. Test for proper alignment, quiet operation, proper connection, pumping capacity, and satisfactory performance.
4. Witnessed factory test of the entire PLC based control system and HMIs is mandatory. Entire system must be set up and tested as specified in this section and in Section 40 99 90, Package Control Systems. Upon completion, and prior to shipping equipment to the site, provide electronic copies of all PLC ladder logic and control programs, fully documented and suitable for downloading into the PLCs.

3.03 INSTALLATION

A. Seller shall furnish written installation instructions and recommendations to Contractor.

B. Contractor shall install the Membrane Equipment System in accordance with Seller’s instructions and recommendations.

C. Seller shall provide prompt assistance to Contractor during installation as requested.

3.04 TESTING AND COMMISSIONING

A. Procedures: Per Section 01 43 34, Special Services.

B. Following the Seller’s calibration of instruments, the Seller shall coordinate and assist Contractor with Operational Readiness and Performance Acceptance Tests on the installed Membrane Equipment System. It will be the responsibility of the Seller and Contractor to communicate to arrange the

times for testing and startup activities, however, the Contractor must confirm that these times are acceptable to the Buyer.

C. Operational Readiness Testing (ORT):

1. Refer to Section 01 43 34, Special Services, for additional Operational Readiness Testing requirements.
2. Once written certification of proper installation has been issued, Seller shall coordinate with Contractor to perform Operational Readiness Testing of the Membrane Equipment System.
3. For the Operational Readiness Testing, the Seller and the Contractor shall verify operation of all system components, all control system functions, and communication links.
4. To perform the Operational Readiness Testing, the Seller shall operate all valves, controls, and other devices to ensure they are functional and ready for Performance Acceptance Testing.
5. Purpose of the Operational Readiness Testing shall be to demonstrate the effectiveness of the following system components and features:
    a. Automatic START/STOP and flow control of membrane trains using Plant Control System.
    b. Manual flow control using membrane train HMI and PLC.
    c. Automatic backwashing, back pulse, or relaxation at various time intervals.
    d. Automatic shutoff and alarm for various failure modes for each membrane train and for entire Membrane Equipment System.
    e. START and STOP of air system.
    f. Determination of clean water turbidity and permeability of each membrane train and temperature correction of the clean water permeability for each train.
    g. Monitoring and recovery of operating data.
    h. Monitoring and control from remote workstation.
    i. Automatic switchover from normal power to emergency power, and emergency power to normal power.
    j. All control functions, both at local system and remote workstation.
    k. Operation of systems for maintenance and recovery cleans.
    l. Operation of all monitoring instruments.
    m. Bubble point testing of the small membrane subunits.
6. The Seller shall inspect the installed Membrane Equipment System for correct operation, proper connection, and satisfactory function of all components. The Seller shall approve the installation and provide to the Engineer and Contractor written certification that the system components have been installed properly and are ready for operation.
7. The proposed Operational Readiness Testing procedure shall be developed by the Seller and shall be submitted to the Engineer and reviewed by the Contractor and the Engineer before scheduling and

performing Operational Readiness Testing. In the case of a nonconforming system as determined by the Engineer, advancement to Performance Acceptance Testing shall not commence until the Seller has made, at no additional cost to the Buyer, such adjustments and modifications as are necessary to correct the system, and has demonstrated this by repeating the Operational Readiness Testing until satisfactory.

D. Training:

1. Provide training in accordance with Section 01 43 34, Special Services, and as described herein.
2. Seller shall provide training to Buyer's personnel as required for complete understanding of process, mechanical, electrical, and control system relationships.
3. Training shall be completed prior to commencement of Performance Acceptance Testing.

E. Performance Acceptance Testing:

1. Refer to Section 01 43 34, Special Services, for additional Performance Acceptance Testing requirements.
2. Following completion of the Operational Readiness Testing and Training, and following the submittal of all final Shop Drawings, O&M Manuals, and PLC programs, the Seller, Contractor and the Buyer shall conduct the Performance Acceptance Test. Since the Membrane Equipment System is part of the secondary treatment process, wastewater and mixed liquor shall be used for the entire duration of Performance Acceptance Testing and the Performance Acceptance Testing shall be conducted after successful startup of the secondary treatment facility as well as the preceding unit processes such as Fine Screens. During the Performance Acceptance Test, the Seller shall take the lead and be responsible to test the Membrane Equipment System. The Contractor shall be responsible for testing all other equipment associated with the secondary process as part of the overall plant testing. The Buyer shall be responsible for controlling SRT and establishing mixed liquor solids concentrations as specified.
3. A Performance Acceptance Testing procedure shall be developed by the Seller and shall be submitted to the Buyer for review and approval by the Buyer and the Engineer before scheduling and performing Performance Acceptance Test; upon successful completion of the Operational Readiness test.
4. Seller shall submit a Performance Acceptance Test Report within 14 days of completion of the test period.

5. To perform the test, the Seller shall provide full-time assistance to the Buyer over a 60-day test period, and collect and summarize data to demonstrate that the system meets the Performance Acceptance test requirements for the parameters listed below. In all cases, compliance with the requirements of this Specification shall be determined for each calendar day, and to successfully pass the test, the Membrane Equipment System must comply with requirements for each of the 60 days within the Performance Acceptance Test period.
    a. Production Capacity: Membrane Equipment System meets production capacity requirements under conditions specified in Service Conditions and Performance Requirements of this Section.
    b. Pressure Limitations: Membrane Equipment System operates within the TMP limit that is specified by the Seller in Section 00 41 63, Proposal Form.
    c. Membrane Permeate Quality: Membrane permeate meets requirements under conditions specified in Service Conditions and Performance Requirements of this section.
    d. Maintenance Clean: Perform maintenance clean operation at the frequency equal to or less than specified in Performance Requirements of this section.
    e. Recovery Clean: Perform recovery clean operation at the end of the 60-day test period on one membrane train. Using the TMP and temperature corrected permeability data from the 60-day operation, the recovery clean interval, when averaged over 1 year, shall not exceed the maximum frequency specified in Article Performance Requirements of this section.
    f. Energy Usage: Monitor average power consumption and maximum power demand for Membrane Equipment System for duration of test period. Provide a test method prior to start of testing that is acceptable to Buyer. Monitored equipment shall include air scour blowers, permeate pumps, and backwash pumps. Test method shall verify the guaranteed power requirements for the range of flows specified by the Seller in Section 00 41 63, Proposal Form, Schedule A.
    g. Air Scour Usage: Monitor average Air Scour consumption and maximum Air Scour demand for Membrane Equipment System for duration of test period. Provide a test method prior to start of testing that is acceptable to the Buyer. Chemical Use: Monitor chemical use for membrane equipment system cleaning. Verify guaranteed chemical use requirements specified by Seller in Section 00 41 63, Proposal Form, Schedule A.

h. Control System: Verify that the PLC, Process Control, HMI and network communications systems operate as intended. Verify that automatic transfer to redundant or backup systems is functional and that operator intervention to restart or to re-establish normal operation is required only during weekday periods between 8:00 a.m. and 4:00 p.m. Any other manual intervention to restart or to re-establish normal operation of the control system is considered a system failure.

6. Successful completion of the Performance Acceptance Test will be defined as 60 continuous days of operation without a major failure in system and demonstration that the Membrane Equipment System meets all performance requirements established herein.
7. A major failure in the Membrane Equipment System is one that decreases system capacity below 100 percent of design capacity for more than 24 hours, or, for control systems, a major failure is any event that requires operator intervention to restart or to re-establish normal system operation as described above.
8. If the Membrane Equipment System fails to successfully complete Performance Acceptance Test, Seller shall have the option of repeating the test over a second 60-day period. If the Membrane Equipment System fails to successfully complete the Performance Acceptance Test during second test period, Seller shall prepare a written plan for modifying the system to meet all test requirements.
    a. Seller shall submit the written plan within 14 days after the second unsuccessful test period ends.
    b. If the proposed modifications are deemed acceptable by the Buyer and the Engineer, the Seller shall modify the system within 30 days of receiving the Engineer's written approval. All modifications to the system shall be completed at no additional cost to the Buyer or General Contractor.
    c. If any additional equipment is required, Engineer shall calculate associated life-cycle costs for the new components incurred over a 10-year period. These associated costs shall be compensated in full by the Seller in the form of a lump sum payment based on a 10-year net present worth calculation with a 5 percent interest rate. See Section 00 52 63, Agreement Form, for additional information.
    d. After modifications are completed, the Seller shall then repeat the Performance Acceptance Test.
    e. If, in the opinion of the Buyer or the Engineer, the Seller cannot modify or supplement its Membrane Equipment System to meet performance requirements specified herein, the Seller shall remove their system and install an alternate system as required to meet performance requirements at the sole cost of the Seller. This requirement shall be secured by the Performance Bond.

9. During the Performance Acceptance Test, Contractor, Buyer and Engineer shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by Seller.
10. Buyer and Engineer shall have the option of witnessing all testing performed by the Seller.

F. Commissioning Period:

1. Compliance with the requirements for production capacity, chemical cleaning interval, and membrane permeate quality shall be determined during the Commissioning Period.
2. The Commissioning Period shall begin and end at the Buyer's discretion, within the limits defined herein:
   a. Start of Commission: No later than 2 months after completion of Performance Acceptance Testing.
   b. Duration: 180 days.
3. It is the Buyer's intent to time the Commissioning Period to coincide with peak flow conditions, or to simulate those conditions using a substantial portion of the plant to the extent possible with the flow available at startup.
4. The Buyer shall operate the plant during the Commissioning Period, however, Seller and Contractor shall be allowed to provide onsite assistance.
5. Seller is responsible for monitoring operating conditions and performance during the Commissioning Period.
6. Seller shall summarize data at the end of the Commissioning Period and prepare a written report of the results to the Buyer and the Engineer.
7. The Commissioning Period Report shall include a narrative description, tables and graphs of production capacity, TMP versus time, energy use, maintenance clean and recovery clean frequency, and other parameters to document the performance of the Membrane Equipment System.
8. Seller shall submit the Commissioning Period Report within 30 days following the end of the Commissioning Period.
9. The Buyer and Engineer may conduct their own monitoring and record keeping during the Commissioning Period.
10. The following parameters shall be evaluated to determine compliance of the Membrane Equipment System with Performance Requirements as stated herein:
    a. Membrane Permeate Quality: If the Membrane Equipment System fails to comply with requirements for membrane permeate quality, Seller shall immediately provide to the Buyer and the Engineer a written plan of modifications to the system (such as repairing damaged fibers, replacing seals, complete replacement of system) to achieve compliance with the requirements. Upon

implementation of modifications plan, the commissioning tests shall re-commence in their entirety.

b. Production: If flow capacity does not meet specified requirements, and/or if Transmembrane Pressure exceeds that guaranteed by Seller, Seller shall immediately provide to the Buyer and the Engineer a written plan of modifications to the system (such as repairing damaged fibers, replacing seals, complete replacement of system) to achieve compliance with the requirements. Upon approval by the Buyer and implementation of modifications plan, the commissioning tests shall re-commence in their entirety.

c. Cleaning Interval: If the interval for maintenance and recovery cleans during the Commissioning Period is shorter than the frequency of cleaning specified in this Section to meet the production capacity as described under Performance Requirements, Seller shall immediately provide to the Buyer and the Engineer a written plan of modifications to the system (such as repairing damaged fibers, replacing seals, complete replacement of system) to achieve compliance with the requirements. Upon implementation of modifications plan, the commissioning tests shall re-commence in their entirety.

G. Telephone Support:

1. Seller shall provide continuous (24 hour, 7 days per week, including weekends and holidays) telephone support by means of a toll-free phone number for a minimum period of 5 years following commissioning.
2. Seller shall provide a list of names of three or more individuals qualified to support operation, and provide pager numbers for these individuals, if available. At least one of the listed individuals shall be available at all times (24 hour, 7 days per week, including weekends and holidays) in the event of an emergency.

3.05 SELLER'S SERVICES

A. Provide onsite services in accordance with Section 01 43 34, Special Services, as described herein.

B. In addition to the time necessary to complete the requirements established elsewhere within these Contract Documents, the Seller shall provide the following onsite services at times designated by the Buyer and Contractor, for the minimum person-days listed below, travel time excluded. Time spent remedying equipment deficiencies/problems shall not count toward the listed person-days and trips.

1. 10 person-days (three trips) for attendance at design workshops held at Engineer's or Buyer's office as specified in Article Services During Design, Paragraph E.

2. 4 person-days (two trips) during unloading of Membrane Equipment System, including attendance at a 1-day predelivery site meeting with the Contractor.
3. 15 person-days (three trips) for providing installation assistance to the Contractor for the Membrane Equipment System.
4. 8 person-days (three trips) for training of Buyer's operators, including attendance at a 1-day prestartup meeting with the Contractor and the Buyer and a 2-day review of operations at the end of the first year of operation.
5. Provide full-time assistance during Operational Readiness Testing and Performance Acceptance Testing Periods.
6. 40 person-days (eight trips) for assistance during and after Commissioning Period.

END OF SECTION

SECTION 44 42 19.04
ROTARY POSITIVE DISPLACEMENT BLOWER

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gear Manufacturers Association (AGMA).
2. American National Standards Institute (ANSI).
3. ASTM International (ASTM):
   a. A48/A48M, Standard Specification for Gray Iron Castings.
   b. A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. National Electrical Manufacturers Association (NEMA).

1.02 DEFINITIONS

A. Absolute Discharge Pressure: Pressure in pounds per square inch absolute (psia) at the blower discharge flange in relation to Job Site barometric pressure.

B. BHP: (Shaft) brake horsepower is the standard curve horsepower required corrected for pressure, temperature and relative humidity at inlet conditions.

C. Blower Discharge Temperature: The highest possible temperature in degrees F of the air leaving the blower under any operating scenario assuming inlet air conditions equal to those for the guarantee point. This number is used to determine whether CPVC is allowable for ALP piping, defined by the pipe schedule in Section 40 27 00, Process Piping—General.

D. Discharge Pressure: Pressure in pounds per square inch gauge (psig) at the blower discharge flange at rated capacity.

E. Inlet Cubic Feet per Minute (ICFM): Volumetric rate of air at the inlet flange of the blower corrected to absolute pressure, temperature, and relative humidity. The pressure takes into account the inlet piping in filter pressure drops.

F. MPCS (Membrane Package Control System): Membrane package control system responsible for control and monitoring of all functions within the scope of the MBR system. Refer to Section 40 99 90, Package Control Systems.

G. Pressure Rise: Pressure developed within the blower between the inlet and outlet flanges. It is the discharge pressure less the inlet pressure measured at the discharge and inlet flanges, respectively.

H. Standard Cubic Feet per Minute (SCFM): Volumetric rate of air measured in standard cubic feet per minute at 68 degrees F, pressure of 14.7 psig, and relative humidity of 36 percent.

1.03 SYSTEM DESCRIPTION

A. Blower system, featuring rotary positive displacement blower(s) to supply air for the membrane scour and membrane tank aeration. Provide blower system that meets all other requirements of Section 43 32 56, Membrane Equipment System (Membrane Bioreactor).

B. Provide blower system, including, but not limited to, blowers, control panel, motors, drives, guards, drive couplings, baseplates, vibration isolators, supports, inlet silencers, discharge silencers, bypass silencers, relief valves, flexible connectors, noise enclosures, spare parts, outside air filter, and miscellaneous appurtenances as necessary.

1.04 DESIGN REQUIREMENTS

A. Design equipment with due regard to safety of operation, accessibility, and durability of parts, and complying with applicable OSHA, state, and local safety regulations.

B. Each blower will receive outside air from a dedicated filter and discharge into a main air discharge header.

C. Intermittent and continuous operation in an indoor environment, with ambient temperatures ranging from 45 degrees F to 90 degrees F.

D. Blower(s) shall start no more than four times per hour when operating in intermittent service.

E. Blowers shall meet rated performance and sound level when operating at a maximum gear tip speed of 3,750 feet per minute. Operating speed shall not exceed 80 percent of rated speed.

F. Maximum Sound Pressure Level: 80 dBA total noise, factory calculated, with inlet and discharge silencers, measured 1 m from enclosure. A separate requirement is for 75 dBA total noise, factory calculated 1 m from the opening of the suction pipe to the atmosphere (or alternatively 1 m upstream of the first silencer inside the suction pipe). This calculation would count silencing from a suction silencer(s) but not assume the sound is contained within the suction pipe, and this calculation does not count silencing provided by

acoustic enclosure as the suction pipe penetrates the enclosure. This suction pipe noise requirement shall be calculated at both min and max turndown for the proposed blower system.

G. Performance Requirements:

Design Conditions	
Design Capacity, scfm	As required by membrane supplier
Design Capacity, icfm	As required by membrane supplier
Maximum Capacity, icfm	As required by membrane supplier
Altitude, ft	130
Barometric pressure, psia	14.7
Inlet pressure at compressor flange, psia	As required by membrane supplier
Inlet air temperature, degrees F (Guarantee Point)	88
Inlet air temperature range, degrees F	21 min to 113 max
Relative humidity, % (Guarantee Point)	26
Discharge pressure at compressor discharge flange, psia	As required by membrane supplier
Blower pressure rise required, psi	As required by membrane supplier
Pressure relief valve setting, psig	As required by membrane supplier
Shaft brake horsepower, BHP1,2	As required by membrane supplier

[1]Includes main oil pump, if specified, and all gear and bearing frictional losses.

[2]Not to exceed motor nameplate horsepower at 1.0 service factor at the inlet air temperatures, pressure relief valve setting and altitude listed above.

1. The blower pressure rise, to be determined by membrane supplier, shall be sufficient to deliver air to the membrane diffusers and shall account for simultaneous maximum flow, highest inlet temperature, all inlet and outlet piping pressure losses, all minor losses associated with valves, fittings, package inlet and inlet pipe silencers, a dirty inlet filter, maximum water surface level in the membrane tank during aeration, and any fouling that may occur on the diffusers.

1.05 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

B. Refer to Section 40 99 90, Package Control Systems, and control panel requirements.

C. Action Submittals:

1. Shop Drawings:
   a. Motor information as required per Section 26 05 01, Electrical.
   b. Sound Enclosure:
      1) Complete description of sound enclosure and accessories.
      2) Calculated noise attenuation.

D. Informational Submittals:

1. Factory calculated sound levels (dBA) of blower unit with silencers and sound enclosure.
2. Identification of outside utility requirements for each component such as air, water, power, etc. Include operating parameters for required utilities.
3. Suggested spare parts list to maintain the equipment in service for a period of 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
4. Operation and Maintenance Data as specified in Section 01 30 00, Administrative Requirements.
5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

1.06 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts, special tools, and materials:

Item	Quantity
Oil, synthetic	Sufficient gallons for standard oil change interval
Inlet Filters	Enough for 1 complete changes per unit
Flexible Coupling	One complete set
Drive V-Belts (as applicable)	One complete set per unit

Item	Quantity
Special tools required to maintain or dismantle	One complete set for each unit

B. Delivery: In accordance with Section 01 61 01, Product Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General:

1. Where possible, provide end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, replacement, and manufacturer's service.
2. Manufacture spare parts to United States standard sizes and gauges.

B. Materials, equipment, and accessories specified in this section shall be products of:

1. Aerzen.
2. Kaeser.

2.02 COMPONENTS

A. Blower:

1. Rotary positive displacement type, driven by horizontal electric motor.
2. Casing: One-piece construction, ASTM A48/A48M, Class 30B close-grain cast iron strongly ribbed to prevent distortion at the specified operating conditions. Separate headplates of cast iron.
3. Bearings:
   a. Each shaft and impeller assembly shall be supported by double-row spherical roller bearings sized for a minimum L10 rating of 100,000 hours.
   b. Drive end bearings shall be fixed to control axial location of impeller assembly.
   c. Bearings and gears shall be lubricated by a splash type lubrication system on both ends of the rotors.
   d. Provide each bearing with a positive lip type oil seal designed to prevent lubricant from entering air stream and a labyrinth seal on each shaft designed to reduce air leakage at point where shaft extends through headplate of blower casing.
   e. Make further provision to vent area between the two sealing systems to atmosphere to relieve excessive pressure on seals.

4. Impellers:
    a. Each impeller/shaft assembly integrally cast from high-strength ASTM A395/A395M Type 60-45-15 ductile iron with a minimum tensile strength of 60,000 pounds per square inch.
    b. Three-lobe minimum involute type, rotating in opposite directions in a common casing without rubbing, liquid seals, or lubrication. Lobes may be straight or axially rotated to enhance efficiency with internal compression.
    c. Positioned by timing gears to maintain proper clearances.
    d. Impellers and timing gears shall be mounted on shafts supported by antifriction bearings, fixed to control the axial location of impeller/shaft in the casing.
    e. Statically and dynamically balanced by removing metal from impeller body.
    f. Positively timed by a pair of accurately machined and carborized steel spur gears hardened to 58-62 Rockwell alloy timing gears manufactured to comply with AGMA. Gears mounted on shafts with tapered fit and secured by a locknuts.
5. Shafts:
    a. Cast iron, integral with impellers or alloy steel.
    b. Machine labyrinth seals into shaft to minimize air leakage.
6. Direct-Drive Coupling (as applicable):
    a. Service Factor: 1.5 on horsepower.
    b. Guard over coupling.
    c. Manufacturers:
        1) Falk.
        2) Dodge.
7. Belt Drive (as applicable):
    a. V-belt drive with automatic belt tension device.
    b. Minimum service factor of 1.4.
    c. Designed not to exceed allowable overhung load limits of blower and motor.
    d. Provide belt guard.

B. Motor:

1. Squirrel-cage ac induction type, meeting requirements of Section 26 05 01, Electrical, and as specified herein.
2. Motor Horsepower: As required my membrane manufacturer.
3. Nominal Speed: 1,750 rpm, variable.
4. Rated Voltage: 460 volt, three-phase, 60-Hz.
5. Enclosure Type: TEFC as specified in Section 26 05 01, Electrical.
6. Inverter duty rated.
7. Drive: Direct-drive coupling or V-belt drive.

C. Blower Support:

1. Baseplate: Cast iron or fabricated steel mounted on concrete equipment pad.
2. Support Stand: Designed by manufacturer and shall be reinforced to withstand anticipated loadings of blower, motor, inlet and discharge silencers and associated piping.
3. Factory mount blower and motor as a package.
4. Provide vibration isolators to limit transmission of vibration to anchor points at floor.

2.03 ACCESSORIES

A. Air Inlet Filter:

1. Provide individual filters for each blower.
2. Provide 98 percent removal efficiency on 10 micron and above.
3. Furnish with factory-mounted support legs or integrally mounted onto blower skid.
4. Support leg height shall be field coordinated by Contractor.
5. Manufacturers:
   a. Universal.
   b. Stoddard.
   c. Endustra Filter Mfg.
   d. Aerzen.

B. Inlet, Discharge Silencers:

1. Designed to reduce pulsation from rotary lobe blowers at blower operating timing gear speed to meet performance requirements.
2. For timing gear speeds below transition speeds, use a multi-chambered reactive type silencer, and for timing gear speeds at or above transition speed, use a multi-chambered reactive and absorptive type silencer packed.
3. Inlet/Outlet Air Velocity: 5,500 feet per minute, maximum.
4. Pressure Loss: 6 inches of WC maximum, through silencer at design flow rate.
5. Inlet and outlet flanges shall match the piping size shown on Drawings and blower flanges. Flange drilling shall be 125-pound ANSI standard.
6. Provide drain coupling and plug.
7. Manufacturers and Products:
   a. Intake Silencer: Universal; Stoddard flanged inlet and discharge. Silencers may be integrally mounted to blower skid. More than one intake silencer may be required for each blower intake due to suction piping penetrating acoustic enclosure.

b. Discharge Silencer: Universal; Model Stoddard, flanged inlet and discharge, modified as shown complete with support base.
c. Other manufacturer standard silencers will also be considered.

C. Flexible Connectors:

1. Pressure spool, single arch, expansion joint type with 125-pound ANSI flanges, sized to match blower flanges.
2. Operating Temperature Rating: 250 degrees F.
3. Install on each blower at inlet and outlet flange.
4. Thrust restraint rods on discharge if not otherwise restrained.
5. Manufacturers and Products:
   a. Mercer; Style 500.
   b. General Rubber; Style 1015.
   c. "Or-equal."

D. Check Valve:

1. Dual-plate, metal hinged wafer type for each blower; installed in blower discharge piping downstream of silencer and relief valve. Pressure loss not to exceed 0.4 psid at maximum flow.
2. Cast iron body, stainless steel pin and spring, and two semicircular bronze or stainless steel plates.
3. Seat: Viton or Silicone for high temperature operation. Elastomeric hinges will not be allowed.
4. Manufacturers:
   a. Cameron.
   b. TECHNO US Valve.
   c. Pentair.

E. Safety Relief Valve:

1. Flanged, spring type.
2. Sized to relieve entire discharge flow without overloading blower.
3. Furnish one for each blower.
4. Internally mounted to blower skid or shipped loose for mounting to piping.

F. Temperature Sensor:

1. Provide HIGH discharge air temperature sensor, rated NEMA 4, for each blower.
2. Locate sensor directly after blower discharge.

G. Noise Enclosure:

1. Total Noise Enclosure: See design requirements for performance criteria.

H. Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 100 pounds.

I. Equipment Identification Plates: Provide 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component in a readily visible location. Plate shall bear 3/8-inch high engraved block type black enamel filled equipment identification number and letters.

J. Furnish manufacturer approved vibration isolation pads for mounting blower skid to concrete.

1. Number and Type: As recommended by blower manufacturer and approved by Engineer during design.

2.04 INSTRUMENTATION AND CONTROLS

A. Instrumentation and controls work of this section shall be in accordance with Section 40 99 90, Package Control Systems, and Section 40 91 00, Instrumentation and Control Components. External signal interfaces are required to interface the blower system with the MPCS. The MPCS shall directly control the blowers and provide means for automatic and manual control. Provide items not specifically called out which are required to implement functions required for proper system operation. Control panels provided with the blower shall provide hardwired functions. Automatic control functions shall be integrated to the MPCS PLC logic. The following is a list of functional requirements to be provided using blower skid mounted controls/instrumentation and the MPCS. See other sections for additional requirements.

1. Hand Switches:
   a. Disconnect switch.
   b. LOCAL/OFF/REMOTE.
   c. START/STOP.
   d. RESET for blower fail.
2. Indicating Lights:
   a. Blower FAIL.
   b. HIGH differential air pressure.
   c. Amber STOP.
   d. Blower ON.
   e. Blower OFF.

3. Miscellaneous:
    a. RUN time meter.
    b. High inlet vacuum shutdown.
    c. Discharge High Temperature Shutdown: 0 degree to 350 degree range, NEMA 4 mounted, field adjustable, as manufactured by Ashcroft.
    d. Discharge High Pressure Shutdown: 5 psig to 15 psig range, NEMA 4 mounted, field adjustable, as manufactured by Ashcroft.
    e. Inlet and Discharge Pressure Gauges: Liquid filled, 4.5-inch face, as manufactured by Ashcroft.
    f. Inlet and Discharge Temperature Gauges: Minus 20 degrees F to 120 degrees F inlet, 50 degrees F to 400 degrees F discharge, 5-inch-diameter dial every angle, as manufactured by Ashcroft.

B. Control Panel External Interfaces:

1. Discrete Outputs to:
    a. Dry contacts shall be noble metal or hermetically sealed, and suitable for 5 amps at 120V ac.
    b. REMOTE status.
    c. Common FAIL alarm contact that closes on the occurrence of any of the following conditions (to be used by MPCS):
        1) HIGH differential air pressure.
        2) HIGH discharge temperature
        3) Motor OVERTEMP.
2. Discrete Outputs to MCC:
    a. Dry contacts rated for 10 amps at 120V ac for use in motor starter circuit.
    b. RUN.
3. Discrete Inputs:
    a. Contact Rating: 5 amps at 120V ac.
    b. Sensing Voltage: 120V ac.
    c. START/STOP from MPCS.
    d. HIGH differential air pressure from field devices.
4. Discrete Inputs from MCC:
    a. Dry contacts rated for 10 amps at 120V ac for use in motor starter circuit.
    b. Sensing Voltage: 120V ac supplied by control panel.
    c. Blower ON.
    d. Motor OVERTEMP.
5. Signals that interface with MPCS shall be wired to a terminal block in each panel.
6. Contacts:
    a. Material: Gold or silver.
    b. Minimum Rating: 5 amps, 120V ac.

c. Discrete Outputs:
   1) Alarm: Single-pole, double-throw (SPDT) dry type.
   2) Other: Single-pole, single-throw (SPST) dry type.
d. Wire each discrete alarm output relay contact to a terminal strip for interfacing to MPCS.

C. System Operation:

1. Functional Requirements: Provide at each blower or at membrane system control panel:
   a. RESET pushbutton and associated logic for the common FAIL alarms. When alarm condition occurs, indicate associated condition at panel. Local indication of alarm condition shall remain until condition has been corrected and RESET pushbutton pressed.
   b. Control logic to monitor operation of blower and provide a contact closure output to motor control center when prestartup or operating conditions are normal. Open contact if a HIGH differential air pressure between blower inlet and outlet condition or HIGH discharge air temperature is detected.
   c. Indicate blower shutdown and problem using latching relays.

2.05 SHOP/FACTORY FINISHING

A. Furnish coating system in accordance with system Number 5, as defined in Section 40 27 00, Process Piping—General, as a minimum coating requirement. Color as selected.

2.06 SOURCE QUALITY CONTROL

A. Blower Performance Test:

1. Notify Engineer at least 7 days prior to performing test.
2. Perform on the blower actually furnished in accordance with manufacturer’s established criteria.
3. Test each blower for a minimum of 1 hour after stabilization at conditions near the performance ratings for mechanical integrity and flow performance.
   a. Perform at or above specified performance pressure rise.
   b. Tolerance on Flow: Plus or minus 4 percent, after correction to rated conditions.
4. Perform Slip Test in accordance with manufacturer’s established criteria.
   a. Describe the testing configuration.
   b. Document operating conditions, temperatures, pressures, blower speed, etc.

c. Complete slip calculations at test conditions.

5. Measure power consumption using a calibrated wattmeter.
6. Test Report: Confirm capacity and power, complete with data and calculations used in the test.

B. Motor Test: See Section 26 05 01, Electrical.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Perform the following field testing in coordination with the installing Contractor.

B. Functional Test: Prior to facility startup, conduct on each Blower System, assisted by manufacturer's representative, for correct rotation, proper alignment and connection, quiet operation, and satisfactory specified performance.

3.02 MANUFACTURER'S SERVICES

A. Provide the following manufacturer's services in coordination with the installing Contractor.

B. Manufacturer's Representative: Present at Site or classroom designated by Owner for minimum person-days listed below, travel time excluded:

1. 1-person-day for installation assistance and inspection.
2. 1-person-day for functional testing and completion of Manufacturer's Certificate of Proper Installation.
3. 1-person-day for post-startup training of Owner's personnel.

C. See Section 01 43 34, Special Services.

END OF SECTION

SECTION 44 42 56.10
HORIZONTAL END SUCTION CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Bearing Manufacturers' Association (ABMA).
2. Hydraulic Institute Standards.
3. National Electrical Manufacturer's Association (NEMA): MG 1, Motors and Generators.
4. Occupational Safety and Health Administration (OSHA).

1.02 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.03 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

B. Action Submittals:

1. Shop Drawings:
   a. Make, model, weight, and horsepower of each equipment assembly.
   b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over entire operating range of pump from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at guarantee point.
   d. Detailed structural, mechanical, and electrical drawings showing equipment dimensions, size, and locations of connections and weights of all equipment.
   e. Equipment center of gravity, anchor bolt layout, anchor bolt spacing, and other pertinent information required to anchor the equipment.
   f. Motor information as required per Section 26 05 01, Electrical.

g. Letter of proper application from pump manufacturer listing the acceptable range of pump conditions (shown on pump curve) at which the pump can continuously operate without damage.

C. Informational Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's printed installation instructions.
3. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
4. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
5. Operation and Maintenance Data: As specified in Section 01 30 00, Administrative Requirements.
6. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

1.04 EXTRA MATERIALS

A. Furnish for each model and size of pump:

1. Complete set bearings.
2. Complete set gaskets and O-ring seals.
3. Complete set of shaft sleeves.
4. Complete mechanical seal.
5. One complete set of special tools required to dismantle pump.

PART 2 PRODUCTS

2.01 GENERAL

A. Coordinate pump requirements with drive manufacturer and be responsible for pump and drive requirements.

B. Where variable frequency drives are required, furnish a pump with design points that are compatible with the drive and speed controller as well as pump.

C. Pump selection shall allow for the pump's application, design, and installation to be in accordance with the Hydraulic Institute Standards. The membrane manufacturer is responsible for the hydraulic performance of the pump, and the pump shall not cavitate or be required operate outside of the pump manufacturer's recommended continuous operating design points in order to meet the operation requirements of the Membrane System.

2.02 SUPPLEMENT

A. Some specific requirements are attached to this section as supplement.

2.03 ACCESSORIES

A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.

B. Lifting Lugs: Equipment weighing over 100 pounds.

C. OSHA-approved coupling guard for direct coupled or belt driven pumps.

2.04 FACTORY FINISHING

A. Manufacturer's standard enamel finish.

2.05 SOURCE QUALITY CONTROL

A. Factory Tests and Adjustments: Test all equipment actually furnished.

B. Factory Test Report: Include test data sheets, curve test results. Functional Test: Perform manufacturer's standard, test on equipment.

C. Performance Test:

1. In accordance with Hydraulic Institute Standards.
2. Adjust, realign, or modify units and retest in accordance with Hydraulic Institute Standards if necessary.

D. Motor Test: See Section 26 05 01, Electrical.

E. Hydrostatic Tests: Pump casing(s) tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Perform the following field testing in coordination with the installing Contractor.

B. Functional Tests: Conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.

2. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.

C. Performance Test:

1. Conduct on each pump.
2. Perform under simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Test Log: Record the following:
   a. Total head.
   b. Capacity.
   c. Horsepower requirements.
   d. Flow measured by plant instrumentation and storage volumes.
   e. Average distance from suction well water surface to pump discharge centerline for duration of test.
   f. Pump discharge pressure converted to feet of liquid pumped and corrected to pump discharge centerline.

3.02 MANUFACTURER'S SERVICES

A. Provide the following manufacturer's services in coordination with the installing Contractor.

B. Manufacturer's Representative: Present at Site or classroom designated by Buyer, for minimum person-days listed below, travel time excluded:

1. 1 person-day for functional testing and completion of Manufacturer's Certificate of Proper Installation.
2. 1 person-day for post-startup training of Buyer's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by Engineer.

C. See Section 01 43 34, Special Services.

3.03 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification:

1. Horizontal End Suction Centrifugal Pump Data Sheet.

END OF SECTION

HORIZONTAL END SUCTION CENTRIFUGAL PUMP DATA SHEET

Tag Numbers: To be determined

Pump Name: Permeate Pumps, Backpulse Pumps, and Membrane Tank drain pumps; number to be determined by manufacturer

Manufacturer and Model Number:
(1) Goulds
(2) Flowserve
(3) Cornell
(4) Flygt
(4) Sulzer

SERVICE CONDITIONS

Liquid Pumped (Material and Percent): Permeate or mixed liquor

Pumping Temperature (Fahrenheit): Normal: 70 Max 80 Min 40

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: 1.0 cP

pH: 7.0

Abrasive (Y/N) N Possible Scale Buildup (Y/N): N

Total suspended solids (mg/L)

Largest diameter solid pump can pass (inches) 1/4 minimum

Min. NPSH Available (Ft. Absolute): As determined by membrane supplier

Suction Pressure (Ft): As determined by membrane supplier

PERFORMANCE REQUIREMENTS AT PRIMARY DESIGN POINT

Capacity (US gpm): Rated: As determined by membrane supplier

Total Dynamic Head (Ft): Rated: As determined by membrane supplier

Min. Hydraulic Efficiency (%): As determined by membrane supplier

Maximum Shutoff Pressure (Ft): As determined by membrane supplier

Max. Pump Speed at Design Point (rpm): 1,165

Constant (Y/N): N Adjustable (Y/N): Y

DESIGN AND MATERIALS

ANSI (Y/N) ____ Standard (Y/N) Y____ Design: Frame-mounted (Y/N) Y_____
Close-Coupled Casing (Y/N) N__ Back Pullout (Y/N) Y_____

Discharge Orientation: _____ Rotation (view from end coupling): _____

Casing Materials: Cast Iron

Impeller: Type: As required for service_____ Material: As required for service

Impeller Wear Ring (Y/N): Manufacturer's standard

Shaft Material: AISI Type 4340 Alloy Steel

Shaft Sleeve Material: AISI Type 316 Stainless steel

Shaft Seal: Mechanical____ Packing (Y/N) N_____ Material: _____

Mechanical (Y/N) Y_____ Type: Standard, no seal water

Lubrication: Pumped fluid

ABMA L-10 Bearing Life (Hrs): 100,000_____ Lubrication: Grease

Coupling: _____ Falk (Y/N) Y_____ Fast (Y/N) Y_____
Spacer (Y/N) Y_____
Baseplate: Design: AISI Type 1045 Carbon Steel

Drive Type: Adjustable Speed, VFD by others

Other: _____

DRIVE MOTOR (See Section 26 05 01, Electrical)

Horsepower: As required by membrane manufacturer

Voltage: 480_____ Phase: 3_____ Synchronous Speed (rpm): 1,200

Service Factor: 1.0_____ Inverter Duty (Y/N) Y

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: DIP ____ EXP ____ ODP ____ TEFC _Y__ CISD-TEFC ____
TENV ____ WPI ____ WPII ____ SUBM ____

Mounting Type: Horizontal _____ Nonreverse Ratchet (Y/N) _____

REMARKS

Pump manufacturer shall issue a letter stating the pump can run continuously without damage at any operational point used by the membrane manufacturer, taking into account final hydraulic conditions.

SECTION 44 42 56.14
LOBE PUMPS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Bearing Manufacturers' Association (ABMA).
2. American Iron and Steel Institute (AISI).
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
   a. A48/A48M, Standard Specification for Gray Iron Castings.
   b. D2240, Standard Test Method for Rubber Property—Durometer Hardness.
5. Hydraulic Institute Standards (HIS): 9.6.4, Rotodynamic Pumps for Vibration Analysis and Allowable Values.
6. National Electrical Manufacturers' Association (NEMA): MG 1, Motors and Generators.

1.02 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to ratings and nomenclature of the Hydraulic Institute Standards.

1.03 SUBMITTALS

A. Refer to Section 01 30 00, Administrative Requirements, for submittal requirements and procedures.

B. Action Submittals:

1. Shop Drawings:
   a. Make, model, weight, and horsepower of each equipment assembly.
   b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over entire operating range of pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at guarantee point.

d. Detailed structural, mechanical, and electrical drawings showing equipment dimensions, size, and locations of connections and weights of associated equipment.
e. Motor information as required per Section 26 05 01, Electrical.

C. Informational Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's printed installation instructions.
3. Suggested spare parts list to maintain equipment in service for a period of 1 year and 5 years. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
4. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
5. Operation and Maintenance Data: As specified in Section 01 30 00, Administrative Requirements.
6. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

1.04 QUALITY ASSURANCE

A. Rotary lobe pump manufacturer shall be ISO 9001 certified.

1.05 EXTRA MATERIALS

A. Furnish for this set of pumps:

1. Complete set of bearings.
2. Complete set gaskets and O-ring seals.
3. Two shaft sleeves if used.
4. Complete set keys, dowels, pins.
5. Two complete mechanical seals.
6. One set wear plates.
7. One set housing segments or radial liners.
8. One pair rotors or rotor tips for each rotors.
9. One complete set of special tools required to dismantle pump.
10. One set timing gears.
11. One pair shafts.

PART 2 PRODUCTS

2.01 ROTARY LOBE POSITIVE DISPLACEMENT PUMP

A. General:

1. Coordinate pump requirements with drive manufacturer and be responsible for pump and drive requirements.
2. Where variable frequency drives are required, furnish a pump with design points that are compatible with the drive and speed controller as well as pump.
3. Pumping units required under this section shall be complete.

B. Pump Design:

1. Some specific requirements are attached to this section as supplements.
2. Designed and fabricated for 24-hour continuous duty at any and all points within specified range of operation, without overheating and without excessive vibration or strain.
3. Parts shall be designed and proportioned to have liberal strength, stability, and stiffness and to be especially adapted for service to be performed. Provide space for inspection, repairs, and adjustment.
4. Working parts of pumps and motors, such as bearings, wearing rings, shaft, sleeves shall be interchangeable between like units and such that Owner may, at any time in future, obtain replacement and repair parts for those furnished in original equipment.
5. Nameplate ratings of motors shall not be exceeded, nor shall design service factor be reduced when pump is operating at point on its characteristic curve up to maximum flow specified herein.
6. Provide mechanical equipment, including drives and electric motors in accordance with applicable OSHA regulations. Unless otherwise specified, provide rigid painted steel or stainless steel guards on rotating assemblies. Guards shall be removable only by use of a tool.
7. Noise level of pump system, unless otherwise noted, shall not exceed limits established by HI 3.1-3.5-2008, Paragraph 3.3.17.3.
8. Lubrication fitting shall be brought to outside of equipment so they are readily accessible from outside without necessity of removing covers, plates, housings, or guards.
9. Mechanical seals, wear plates and rotors shall be replaceable by removing front cover of rotor housing without disassembly of pump unit or pipe system.

C. Pump Castings:

1. Fabricated of ASTM A48, Class 30 or higher cast iron.
2. Pump Rotor Housing: Multi-piece to allow adjustment of rotor running clearance at least twice or shall include radial liners that can be replaced to restore running clearance.

D. Wear Plates:

1. Rear of pump rotor casing and front cover shall be protected with replaceable wear plates having a minimum Brinell hardness of 500.
2. Front cover wear plate shall be reversible.
3. Wear Plate Bolts: Bolts that secure wear plates to castings inside pump assembly shall be stainless steel, hex head type.

E. Rotors:

1. Driven through positive timing gears running in oil.
2. Solid cast-iron rotor cores shall be covered with a layer of Buna-N at an average durometer hardness of 70 as per ASTM D2240. Alternatively, pump may utilize rotors with replaceable Buna-N 70 durometer tips.
3. Geometry:
   a. Rotor core shall be same as that of finished rotor.
   b. Helical with three or four lobes to provide a near pulseless flow.

F. Shafts:

1. Fabricated of alloy steel AISI A4140. C45 Carbon Steel may be substituted if provided with lifetime warranty for the application.
2. Protected from wetting by fluid being pumped or fabricated of carbon steel with ceramic coated stainless steel sleeves through seal area.

G. Mechanical Seals:

1. Mechanical style with silicon carbide seal faces. Cartridge style or component type mechanical seals that use bushings to permanently place seals are acceptable.
2. Seal Holders: Fabricated of materials that are suitable for prolonged corrosion and chemical resistance.
3. Pumps that utilize packing glands or require external flushing for lubrication and cooling are not acceptable.

H. Quench/Blocking Chamber:

1. Oil-filled quench/blocking chamber located behind mechanical seal, and in front of bearing housing lip seal shall be molded into casting of pump.

2. Chamber shall be suitable for fill, from side of pump, through nipples and have an external sight glass or oil bottle for visual inspection of status of mechanical seal operation.
3. Oil shall provide lubrication and cooling of seals.

I. Flanges:

1. Port Connection: ANSI 125-pound or 150-pound rated or greater.
2. Inlet and outlet ports shall be constructed of grey iron, fittings and flanges bolted to rectangular ports on pump casting.
3. Ports shall be oriented horizontally without offset unless otherwise shown on Drawings.

J. Pump Front Cover:

1. Provide access to pump chamber without disconnecting pipe work or bearings.
2. When opened shall provide unhindered access to rotors, wear plate, and mechanical seals.

K. Bearings:

1. Sized to withstand maximum radial or axial load carried by shafts for continuous duty.
2. Minimum ABMA L10 Bearing Life:
   a. Running at Steady or Constant Speed, Load, Pressure and Temperature: 100,000 hours.
   b. Operated with Variable Frequency Drive: 50,000 hours.

L. Timing Gears and Gear Housing:

1. Meet AGMA Class 8 quality minimum.
2. Keyed and timed to prevent contact between rotors and provide smooth and quiet transmission of load.
3. Located in separate oil-filled, cast-iron gear box fitted with built-in sight glass to monitor oil level.

M. Gear Reducer, as required:

1. In-line gear reducer designated for continuous duty at heavy shock load.
2. Meet AGMA Class II, with service factor of 1.4 minimum for pump applications with moderate shock, continuous duty and AGMA Class III, with service factor of 2.0 minimum for heavy shock, continuous duty operation.
3. C-face, mounted with C-face drive motor to form integral gearmotor combination.

N. V-Belt Drive, as required:

1. Motor shall be mounted above pump on adjustable base that allows adjustment of belt tension.
2. Drive shall consist of pulleys with separate hubs attached to shafts with keys.
3. For motors larger than 3 hp, provide a minimum of two belts.
4. Belts and pulleys shall be enclosed in removable metal guard that meets OSHA requirements. Guard shall allow measurement of pump rpm with strobe or contact meter without removing guard.

O. Structural Base: Rotary lobe pump, gear reducer, motor or gearmotor shall be mounted on a structural steel baseplate, with structural channel supports as necessary, complete with couplings, guards, and mounting hardware.

2.02 ACCESSORIES

A. Equipment Identification Plate:

1. 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location giving name of manufacturer, rated capacity, head, speed and other pertinent data. Attach to each pump, motor, and gear reducer.
2. Additionally, pump serial number, model, gear reduction and motor horsepower shall be cut or stamped into steel plate and welded to skid for permanent identification.

B. Lifting Lugs: Equipment weighing over 100 pounds.

2.03 FACTORY FINISHING

A. Prepare, prime, and finish coat in accordance with System No. 5 as specified in Section 40 27 00, Process Piping—General.

2.04 SOURCE QUALITY CONTROL

A. Factory Tests and Adjustments: Test all equipment actually furnished.

B. Functional Test: Perform manufacturer’s standard test on equipment.

C. Performance Test:

1. Conduct on each pump.
2. Perform under simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Test Log: Record the following:
   a. Total head.

b. Capacity.
c. Horsepower requirements.
d. Flow measured by factory instrumentation and storage volumes.
e. Driving motor voltage and amperage measured for each phase.

5. Performance Test Logs: Adjust, realign, or modify units and retest in accordance with Hydraulic Institute Standards, if necessary.

D. Hydrostatic Test: Pump casing tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.

E. Motor Test: See Section 26 05 01, Electrical.

F. Factory Test Report: Include test data sheets.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Perform the following field testing in coordination with the installing Contractor.

B. Functional Tests: Conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.

C. Performance Test:

1. Conduct on each pump.
2. Perform under simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Test Log: Record the following:
   a. Total head.
   b. Capacity.
   c. Horsepower requirements.
   d. Flow measured by plant instrumentation and storage volumes.
   e. Average distance from suction well water surface to pump discharge centerline for duration of test.
   f. Pump discharge pressure converted to feet of liquid pumped and corrected to pump discharge centerline.

3.02 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by Buyer, for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.
2. 1 person-day for post-startup training of Buyer's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by Engineer.

B. See Section 01 43 34, Special Services.

3.03 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification:

1. Lobe Pump Data Sheet.

END OF SECTION

LOBE PUMP DATA SHEET

Tag Numbers: To be determined

Pump Name: Permeate Pumps

Manufacturer and Model Number: (1) Vogelsang

(2) Boerger

(3) LobePro

SERVICE CONDITIONS

Corrosive? _____
Solids Size (Maximum hard solid size/Maximum soft solid size): _____/_____
Liquid Pumped (Material and Percent): _____
Pumping Temperature (Fahrenheit): Normal: _____ Max _____ Min _____
Specific Gravity @ 60 Degrees F: _____ Viscosity Range: _____
Vapor Pressure @ 60 Degrees F: _____ Liquid pH: _____
Abrasive (Y/N) _____ Possible Scale Buildup (Y/N): _____
Total Suspended Solids (mg/L) _____
Suction Pressure (psig): Maximum _____ Rated _____ at Vacuum (in. Hg) _____
Altitude (ft msl): 130 Area Classification: _____ Location (indoor/outdoor): _____

PERFORMANCE REQUIREMENTS AT PRIMARY DESIGN POINT

Capacity (US gpm): Rated As determined by membrane supplier
Total Dynamic Head (psig): Rated As determined by membrane supplier
Maximum Shutoff Pressure (psig): As determined by membrane supplier
Minimum Continuous Flow (gpm): As determined by membrane supplier
Maximum Pump Speed at Design Point (rpm): 500
Constant (Y/N): N Adjustable (Y/N): Y
Maximum Power (BHP): _____ Rated Power (BHP): _____

DRIVE MOTOR (See Section 26 05 01, Electrical.)

Horsepower: As required by membrane manufacturer
Voltage: 480 Phase: 3 Synchronous Speed (rpm)_____
Service Factor: _____ Inverter Duty: _____
Enclosure: EXP _____ ODP _____ TEFC __X___ TENV _____

REMARKS _____

Pump manufacturer shall issue a letter stating the pump can run continuously without damage at any operational point used by the membrane manufacturer, taking into account final hydraulic conditions.

PART 5

DRAWINGS

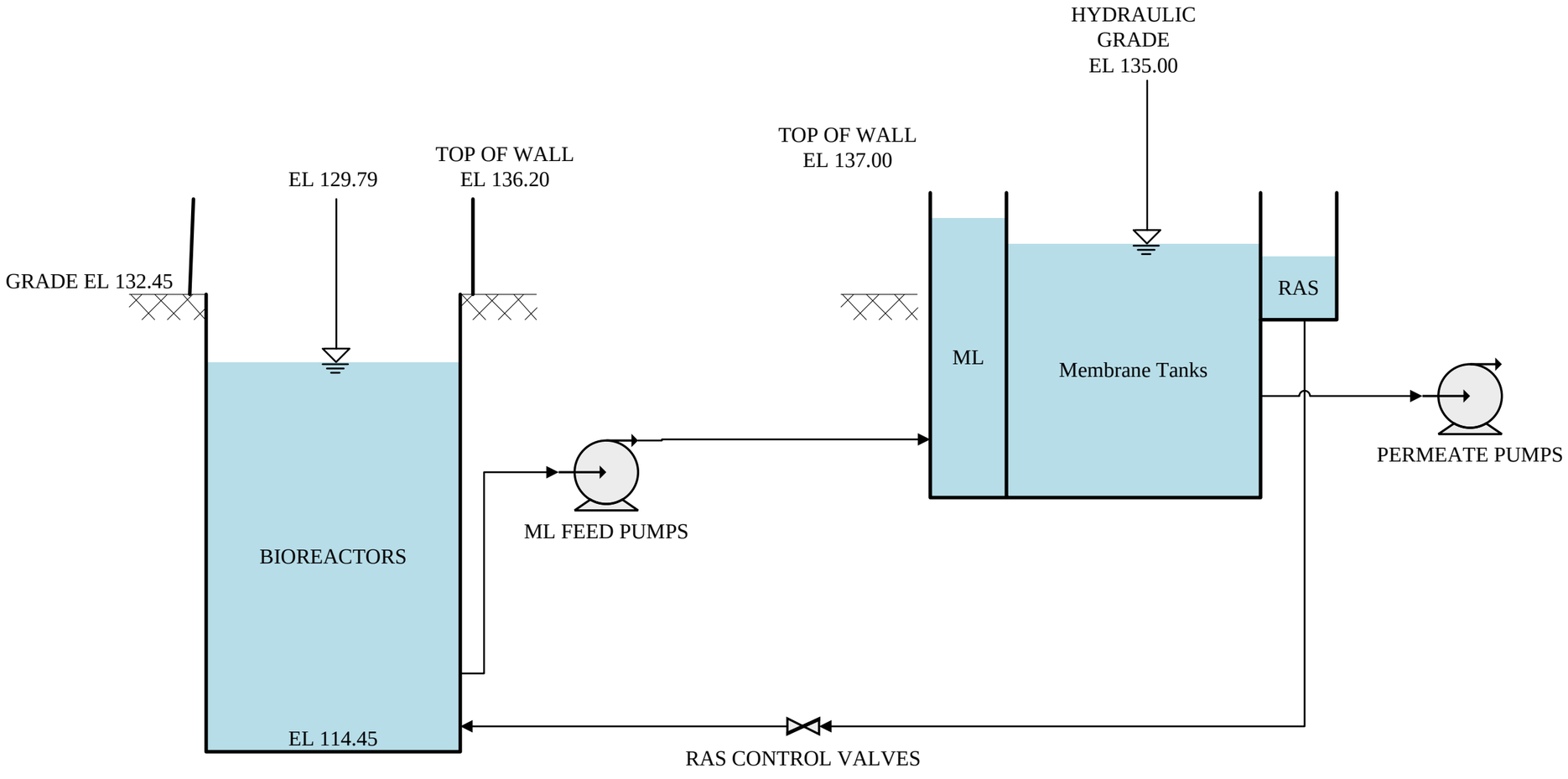


EXHIBIT 1

PRELIMINARY HYDRAULIC PROFILE

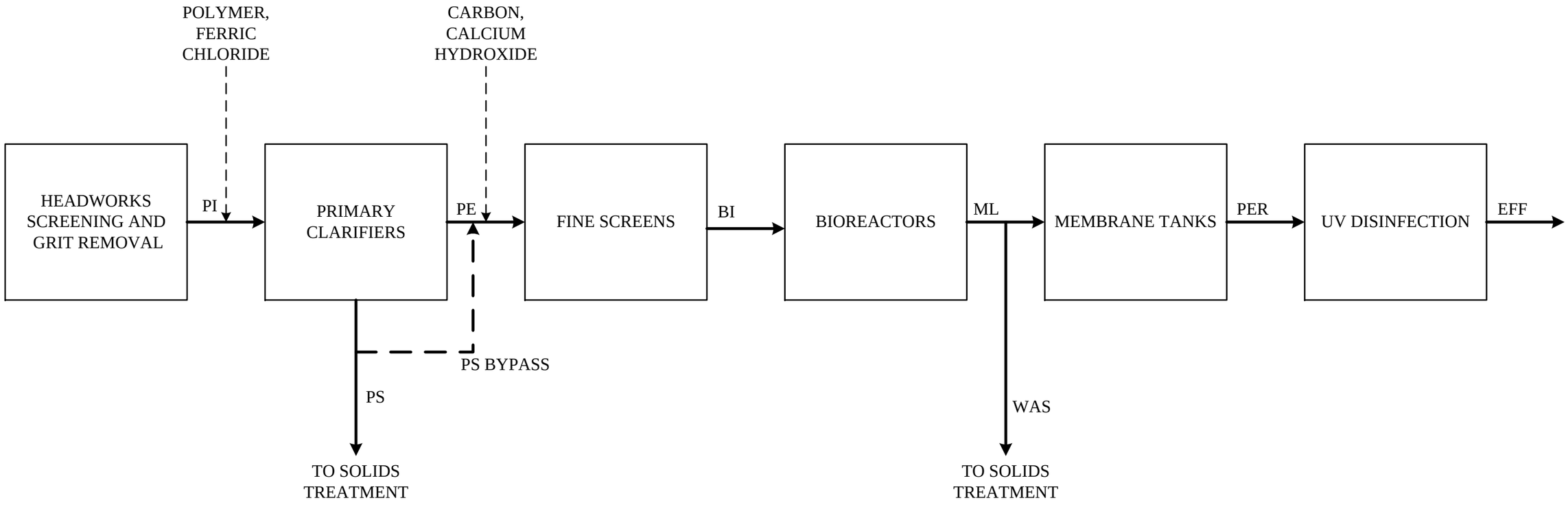


EXHIBIT 2

PROCESS FLOW DIAGRAM