SECTION 01026
SCHEDULE OF VALUES
TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 Requirements

A. Within thirty (30) days of the Notice to Proceed or at the Pre-Construction Meeting (whichever is sooner), Contractor shall submit a Schedule of Values for Owner's approval. The Schedule of Values is a detailed itemized breakdown of all lump sum bid items. Submit corrected Schedule of Values within ten (10) days of receiving Owner's reviewed Schedule of Values requiring correction.

B. The Schedule of Values shall be used as a basis for determining progress payments on a lump sum contract or any designated lump sum bid item. The Schedule of Values shall be a schedule of cost loaded construction activities equal, in total, to the lump sum bid and shall be in such form and sufficient detail to correctly represent a reasonable apportionment of the lump sum. Prior to submitting a monthly payment request, the Contractor shall have submitted a detailed Schedule of Values and obtained approval from the Owner.

C. Each lump sum bid item on the Bid Schedule(s), as set forth in the Contractor's Bid Proposal must be broken down separately. The breakdown of each lump sum bid item must cover the cost of construction required by the Contract Drawings and Specifications for that item. The sum of the values for the construction activities, within a bid item, must equal the total bid amount for that item. The breakdown shall include subcontract amounts, which shall not deviate from the amounts submitted in the Bid Proposal. The Contractor shall provide certification from the Subcontractors certifying the subcontract amounts.

D. Each activity in the Schedule of Values shall delineate one construction activity. For example, the placement of concrete between construction joints, the construction of an electrical duct bank or pipeline between points A & B. The costing for each activity should include all costs for the labor and materials or equipment required to complete the activity. For example, concrete construction activities should include all costs for the forming, placing of reinforcement, placing concrete, and curing. The cost for pipeline construction activities should include materials, equipment and installation including pipeline supports or thrust blocks. The excavation and backfill for a pipeline or structure may be separate activities. The Bid Proposal breakdown shall include the itemized costs for facility startup and testing to be performed before the final project acceptance is made. No non-construction activity shall be cost loaded.

E. Where Contract Documents require a CPM Construction Schedule, the Contractor shall use cost loaded construction activities from the Construction Schedule as a Schedule of Values. Each construction activity shall be encoded to its bid item and a sort provided for each bid item totaling the cost loaded amount. The total of the Cost Loaded amounts for each bid item shall equal the amount bid for that item.

F. The total of the Schedule of Values shall equal the current Contract value at all times. At any time during the progress of the Contract Work, the Owner reserves the right to review the cost loading of the Schedules of Values and direct necessary revisions. When requested by the Owner, the Contractor shall provide all information necessary to substantiate the cost loading.

1.02 Schedule of Values for Projects with Funding

Where project is partially or fully funded by State or Federal loans or grants, the Schedule of Values shall be designed to provide a summary of costs that is coordinated with the funding agency's forms and requirements for disbursements to Owner. Contractor shall cooperate and coordinate with Owner to modify and revise the Schedule of Values and payment requests to achieve a summary of costs acceptable to Owner and the funding agency.

PART 2 - PRODUCTS

(NONE THIS SECTION)

PART 3 - EXECUTION

3.01 Mobilization

Contractor shall limit amounts included under mobilization to the following items (if required by the Contract Documents):

A. Moving onsite any equipment required for first month operations.
B. Temporary construction power.
C. Fire protection system.
D. Construction water supply.
E. Providing field office trailers.
F. Providing onsite sanitary facilities.
G. Providing potable water facilities as specified.
H. Arranging for and erection of Contractor's work and storage yard.
I. Contractor's bonds and insurance.
J. Subcontractor bonds and insurance.
K. Obtaining all required permits, licenses, and fees.
L. Developing construction schedule and Schedule of Values.

Contractor shall furnish data and documentation to substantiate the amounts claimed under mobilization. Total cost for mobilization shall be limited to no more than 5 percent of the Total Contract Amount.

3.02 Example of Categories Required for Schedule of Values

The following is an example of categories required for the Schedule of Values. It represents the minimum level of detail required to quantify the scope of work. Contractor shall provide any necessary additional breakdown of any of the items listed below and Owner may also require

additional breakdown of any and all items. Contractor shall verify all quantities and items of work prior to submittal.

ITEM NO.	DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL COST
1	Mobilization, Bonds, Insurance, Permits, Construction Schedule, and Schedule of Values		LS		$_____
2	Audio-Video Recording		LS		$_____
3	Equipment Items[(1)]				
	A. Materials		LS		$_____
	B. Installation		LS		$_____
	C. Testing		LS		$_____
4	Site Work Activities[(1)]				
	A. Excavation		LS or CY		$_____
	B. Backfill		LS or CY		$_____
	C. Rough Grading		LS or CY		$_____
	D. Fine Grading		LS		$_____
	E. Import/Export		CY		$_____
	F. Dewatering		LS		$_____
	G. Concrete Slabs[(2)]		CY		$_____
	H. Concrete Footings[(2)]		CY		$_____
	I. Paving		SF		$_____
	J. Curbs/Curbs and Gutters[(2)]		LF		$_____
	K. Guard Posts		EA		$_____
	L. Pre-Cast Vaults		LS or EA		$_____
	M. Fencing		LF		$_____
	N. Gates		LS		$_____
	O. Miscellaneous Concrete[(2)]		CY or LF		$_____

ITEM NO.	DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL COST
5	Piping[1]				
	A. Materials (including Fittings)		LF		$_____
	B. Installation		LF		$_____
	C. Supports		EA		$_____
	D. Valves		EA		$_____
	E. Coatings		LS		$_____
	F. Testing		LS		$_____
6	Cast-in-Place Concrete Structures[1]				
	A. Site Preparation		LS		$_____
	B. Demolition (if necessary)		LS		$_____
	C. Excavation		LS or CY		$_____
	D. Backfill		LS or CY		$_____
	E. Dewatering		LS		$_____
	F. Base Materials		LS or CY		$_____
	G. Pump Can Footings[2]		CY		$_____
	H. Pump Can Walls[2]		CY		$_____
	I. Miscellaneous Concrete[2]		CY		$_____
	J. Finishing		LS		$_____
7	Equipment Building				
	A. Site Preparation		LS		$_____
	B. Excavation		LS or CY		$_____
	C. Backfill		LS or CY		$_____
	D. Concrete Foundation[2]		CY		$_____
	E. Concrete Slab[2]		CY		$_____
	F. Masonry Walls		SF		$_____

ITEM NO.	DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL COST
	G. Structural Steel		LS		$_____
	H. Built Up Roofing		LS		$_____
8	Electrical/Instrumentation/ Lighting[(1)]				
	A. Electrical Service Panel/ Distribution Switchboard		LS		$_____
	B. Automatic Transfer Switches		LS		$_____
	C. Motor Control Centers		LS		$_____
	E. Control Panels		LS or EA		$_____
	F. Lighting Panels		LS or EA		$_____
	G. Equipment Control Panels		LS or EA		$_____
	H. Conduit (Above Grade)		LS or LF		$_____
	I. Conduit (Below Grade)		LS or LF		$_____
	J. Conductors (Above Grade)		LS or LF		$_____
	K. Conductors (Below Grade)		LS or LF		$_____
	L. Pull Boxes		LS or EA		$_____
	M. Junction Boxes		LS or EA		$_____
	N. Short Circuit Coordination Study, Arc Flash		LS		$_____
	O. Lighting		LS or EA		$_____
	P. Emergency Standby Generator Terminal Box		LS		$_____
	Q. Pressure Transducers		LS or EA		$_____
	R. Meters		LS or EA		$_____
	U. Other Instrumentation		LS		$_____
	V. Security Systems		LS or EA		$_____
9	Preparation of Operation & Maintenance Manuals		LS		$_____

ITEM NO.	DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL COST
10	Equipment Startup and Performance Testing		LS		$_____
11	Equipment Training		LS		$_____
12	Performance of Live Operational Testing		LS		$_____
TOTAL (MUST EQUAL CONTRACT AMOUNT)					$_____

DO NOT SUBMIT THE SCHEDULE OF VALUES WITH YOUR BID PROPOSAL PACKAGE

Notes:

(1) These work and equipment items shall be broken down by area or facility.

(2) Concrete placements shall be broken down into forming, placement of rebar, placement of concrete, and curing (i.e. successful cylinder breaks). If Schedule of Values does not break down concrete placements into these subcategories, payment will not be made until concrete placements are complete.

END OF SECTION

SECTION 01300
CONTRACTOR SUBMITTALS AND REQUESTS
TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 Description

This Section covers requirements for submittals and forms a part of all other Sections in which submittals are specified or required. This Section also covers Contractor's Requests for Information and Requests for Change.

Submittal Requirements Included in this Section

A. Contractor's Construction Schedule
B. Shop Drawings
C. Material Samples
D. Operation and Maintenance Manuals
E. Requests for Substitutions or Equals
F. Record Drawings

Contractor Requests Included in this Section

A. Requests for Information
B. Requests for Change

1.02 CPM Progress Schedule

Contractor shall submit to Owner a CPM progress schedule to demonstrate the Contractor is sequencing work activities in accordance with the Contract Documents constraints and to assist the Owner in planning the Owner's inspection and operation activities.

A. Within thirty (30) days of Notice to Proceed (or within forty five (45) days of Notice of Award), Contractor shall submit a Critical Path Method (CPM) analysis for construction progress control, prepared on 11" x 17" charts. All construction activities and procurement shall be indicated in a time scaled format and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow or node shall be plotted so that the beginning and ending dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities, and free float for each non-critical activity. All non-critical path activities shall show estimated performance time and free float time in scaled form.

B. The duration estimate indicated for each activity shall be computed in working days and shall be shown on the construction schedule in calendar days. It shall represent the single best estimate considering the scope of the work and resources planned for the activity. Except for certain non-labor activities, such as curing concrete or delivering materials, activity duration shall not exceed ten (10) working days (fourteen (14) calendar days), nor be less than one (1) working day unless otherwise accepted by Owner.

C. Contractor shall revise and resubmit the CPM progress schedule monthly, flagging all slippages and missed mile posts. Contractor shall attach a narrative description of proposed corrective actions to the resubmitted CPM progress schedule, including the following minimum information for each activity and critical path item:

1. Date of initial shop drawing submittal, as applicable.
2. Engineers time for review of shop drawings.
3. Ordering dates for long lead time items.
4. Dates for materials onsite.
5. Early start work dates.
6. Early finish work dates.
7. Late start work dates.
8. Late finish work dates.
9. Date of initial submittal of operation and maintenance manuals.
10. Date of final submittal of operation and maintenance manuals.
11. Testing and cleanup.
12. Final completion.

Contractor shall modify any portions of the construction schedule that become infeasible due to activities behind schedule or for any other valid reason. Any activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.

D. The CPM progress schedule must be submitted to the Owner before the monthly progress payment is made. Scheduling and completion of the project in a timely manner and per Contract completion time, is solely the Contractor's responsibility. The CPM schedules submitted to the Owner shall not modify or revise any Contract provisions presented in the Contract Documents.

E. Although the Owner may provide commentary relative to the Contractor's CPM schedule, the schedule (and related schedule updates) will not be "approved". The Owner will utilize the Contractor's schedules strictly for scheduling of necessary inspection and operations staff and for identifying any apparent conflicts, errors, or misunderstandings of Contract Document requirements by Contractor.

F. The scheduling and work progress is the total responsibility of the Contractor, and work shall be performed to meet the Contract Completion Times or Dates specified in the Contract Documents.

1.03 Shop Drawing Submittal

A. Unless otherwise specified in the Contract Documents, Contractor shall furnish for all equipment and materials to be furnished and installed for the project at least four (4) copies of each shop drawing for Owner's review and approval. Up to three (3) copies will be retained for Owner's use, and the remaining copy will be returned to Contractor.

The term "Shop Drawings" as used herein shall be understood to include all data covering all equipment, equipment components, fabricated materials, and furnished materials.

Data shall include, but shall not be limited to, design calculations, equipment drawings, fabrication and installation drawings, erection drawings, mix designs, operating instructions, catalog sheets, data sheets, lists, graphs, and similar items. Data shall demonstrate full compliance with the Contract Documents.

Contractor shall submit shop drawings in a timely manner. Contractor shall allow sufficient time for Owner's review and approval of shop drawings. Contractor shall be responsible for any project delays resulting from late submittal of initial shop drawings or resubmittal of corrected or revised shop drawings.

B. Method of Submittal

Contractor shall deliver shop drawings submittals by means of dated, signed, and sequence numbered transmittals on Contractor's letterhead. Contractor shall clearly describe the submittal contents, identifying whether initial or subsequent submittals and stating the drawing numbers and specification sections, articles, and paragraphs to which the shop drawings pertain. All data sheets, catalog cuts, or drawings showing more than the particular item under consideration shall be clearly marked to delete all but the applicable information. All data sheets, catalog cuts, or drawings shall be clearly marked to delineate all proposed material and/or equipment options and accessories.

C. Deviations or Exceptions from Contract Documents

Where proposed equipment or materials, equipment components, equipment functions, or equipment operations deviate from the specifications and whenever exceptions to the specifications are taken, it shall be clearly noted on the shop drawing submittals. Deviations shall include references to the specific sections, parts, and paragraphs or drawing numbers and notes for which the deviations or exceptions are made.

D. Contractor's Review

All shop drawing submittals shall be carefully reviewed by Contractor prior to submission to Owner. Contractor shall indicate by a signed and dated stamp on the submittal that Contractor has checked the shop drawings as being correct and in strict conformance with the Contract Documents. When applicable, Instrumentation Subcontractor is also required to indicate by a signed and dated stamp on the submittal that Instrumentation Subcontractor has checked the shop drawings as being correct and in strict conformance with the Contract Documents. Shop drawings not so reviewed by Contractor (or Instrumentation Subcontractor, if applicable) may be returned without action taken by Owner, and any delays caused thereby shall be the responsibility of the Contractor.

During Contractor's review of shop drawings, Contractor is expected to thoroughly review all applicable portions of the Contract Documents for which shop drawings apply. This includes cross checking: General Drawings, Civil Drawings, Mechanical Drawings, Structural Drawings, Electrical/Instrumentation Drawings, Architectural Drawings, Landscape/Irrigation Drawings, and all applicable portions of the Specifications. Contractor shall bring any conflicts, errors, or apparent omissions to Owner's attention in writing during the shop drawing submittal process. If Contractor fails to bring conflicts,

errors, or apparent omissions to Owner's attention during the shop drawing submittal process, Contractor may be required to remove and reconstruct completed work or perform corrective work at Contractor's expense (all as determined by Owner).

E. Owner's Review

1. Owner's review of the shop drawings submitted by Contractor will cover only general conformity to the Contract Documents. The review of shop drawings shall not relieve Contractor of full responsibility for any deviation from the requirements of the Contract Documents, or for providing a complete and operational system per the intended function. As specified above, deviations or exceptions to the Contract Documents (in addition to any conflicts, errors, or apparent omissions in the Contract Documents) shall be clearly indicated on the Contractor's shop drawing submittal. Contractor shall be responsible for any errors or omissions in the shop drawings and for the accuracy of dimensions, quantities, and the design of adequate connections and details. Contractor is also responsible for any conflicts, errors, or apparent omissions in the Contract Documents that are not brought to the Owner's attention during the shop drawing submittal process.

2. Unless specified elsewhere, Owner will return one (1) set of shop drawing submittals to Contractor with his comments noted thereon, within thirty (30) working days following their receipt by Owner. Alternatively, Owner may elect to provide his comments to Contractor via Submittal Comment Sheet. An example Submittal Comment Sheet is attached in this Section for Contractor's reference. Contractor is expected to thoroughly review the Owner's comments, redlines, and dimensional changes for accuracy, and advise if complying with same would prevent the Contractor from providing a complete and operational system per the intended function. It is expected that Contractor shall prepare his submittals in such a manner that he is able to obtain a complete and acceptable submittal by the second submission. Owner reserves the right to deduct monies from the amounts due to Contractor to cover the cost of the Owner's review beyond the second submission. Reimbursement to Owner shall be made by deducting such cost from the Contractor's subsequent payment requests. The reimbursements will be calculated at a flat rate of $200 per hour.

F. Corrections and Resubmittals

Contractor shall make all required corrections and shall resubmit the required number of corrected shop drawings until found in general conformance with the Contract Documents and design concept of the project. Contractor shall respond to all of the Owner's submittal review comments (even if the response is that the comment will be addressed at a later date or under a separate submittal). If Contractor fails to address all submittal review comments, Owner reserves the right to return the entire submittal without review and any delays caused thereby shall be the responsibility of the Contractor. No work which requires shop drawing submittals shall be purchased or commenced until the pertinent shop drawings have been submitted, reviewed, and approved.

1.04 Material Samples Submitted

A. General

Whenever in the Contract Documents material samples are required, Contractor shall submit to Owner not less than two (2) samples of each such item for review and approval, all at no additional cost to Owner. Upon receiving approval by Owner, one (1) set of the samples will be stamped and dated by Owner and returned to Contractor, and one (1) set of samples shall remain at the job site until completion of the work.

B. Delivery

Samples, as required herein, shall be submitted for approval at least thirty (30) days prior to ordering such material for delivery to the jobsite.

C. Identification

Contractor shall label or tag each sample, or set of samples, identifying the manufacturer's name and address, brand name, catalog number, project title, and intended use.

D. Colors, Patterns, and Textures

For items required to be of selected colors, patterns, textures, or other finish, Contractor shall submit sufficient samples to show the range of shades, values, patterns, textures, or other features corresponding to the instructions and requirements specified.

1.05 Operation and Maintenance Manuals

A. Contractor shall provide to Owner six (6) sets of detailed operation and maintenance (O&M) manuals for all mechanical and electrical equipment furnished. Each set shall consist of one (1) or more volumes, each volume shall be bound in a standard size, 3-ring, loose leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5". Binder(s) shall be provided with the following identification inscribed on the cover(s): "Owner's name, project name, Equipment Operation and Maintenance Manual, Volume No." Each volume shall have a table of contents which indicates all equipment in the O&M manual and tabbed divider sheets placed before each section. The O&M manuals shall include (but not be limited to) the following information:

Installation and Operation

1. Installation Instruction
2. Design Capabilities
3. Operating Parameters and Recommended Ranges
4. Specific Equipment Installed, Model No., Serial No., etc.
5. General Literature
6. Operating Instructions
7. Special Problems or Precautions and Emergency Procedures
8. Safety Provisions and Precautions

Maintenance

1. Assembly, Disassembly, and Reassembly
2. Parts List, Including Drawings (Blowup Drawings Preferred)
3. Lubrication Type and Schedule
4. Preventative Maintenance Schedule
5. Recommended Replacement Parts Inventory
6. Details of Calibration and Adjustment
7. Wiring Diagrams (as Installed)
8. Completed Equipment Maintenance Data Sheet (Copy of Form Attached)
9. Equipment Warranties
10. Name, Address, and Phone Number of Local Parts Distributor and Service Center.

B. All O&M manuals shall be submitted to Owner in final form not later than thirty (30) days before startup; all deficiencies contained therein shall be corrected by Contractor within thirty (30) days from the date of written notification by Owner; any deficiencies or changes noted during startup shall be corrected by Contractor and incorporated into the final O&M manuals.

1.06 Requests for Substitutions

A. Any reference in the Contract Documents to any item of equipment or material, by manufacturer's name, make, or other proprietary identification is intended to establish the type, function, and quality required. If the manufacturer's name is followed by the words "or equal" or "or approved equal", indicating that a substitution is permitted, such items of equipment or materials manufactured by others may be substituted provided sufficient information is submitted by the Contractor to allow the Owner to determine that such items of equipment or materials are equivalent to those named in the Contract Documents, subject to the following requirements:

1. Contractor shall demonstrate equality as to type, function, and quality of each substitute item of equipment or material. Owner shall be the sole judge as to equality; Owner's decision shall be final.

2. Contractor shall, within 30 days after Notice to Proceed or within 45 days after award of contract, make written application to Owner to furnish or use a substitute item of equipment or material.

3. Contractor shall submit a list of five (5) installations utilizing the substitute item of equipment or material, including location, contact information (name and phone numbers), and dates of initial operation. The reference provided may be used in part as a basis for establishing the ability of a manufacturer to meet the performance requirements of the specification.

4. Contractor shall submit documentation that the substitute item has been in use or operation for a minimum of five years (unless noted otherwise). Documentation shall include location and references telephone numbers that are familiar with the item.

5. Contractor shall provide Owner with all requested data in order to evaluate proposed substitution.

6. Acceptance by the Owner of a substitute item shall not relieve Contractor of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item. Contractor shall be responsible for any changes and costs which may be required for substitutions.

7. Owner shall be allowed a reasonable time in which to evaluate each proposed substitute. Owner will record the period of time required to evaluate substitutions; Contractor shall reimburse Owner for charges whether or not the proposed substitute is accepted. Reimbursement to Owner shall be made by deducting such cost from the Contractor's subsequent payment requests. The reimbursements will be calculated at a flat rate of $200 per hour.

1.07 Record Drawing Submittal

A. Contractor shall keep and maintain at the jobsite one (1) set of record drawings. Contractor shall mark on drawings all changes in project conditions, locations, configurations, and any deviations which may vary from the details represented on the original Contract Drawings, including, but not limited to, buried or concealed construction and utility features which are revealed during the course of construction. Contractor shall record the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings.

Said record drawings shall be supplemented by detailed sketches as necessary to indicate the work actually constructed. These master record drawings of Contractor's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like, shall be maintained up-to-date during the progress of the work. Record drawings shall be accessible to Owner at all times during the construction period and shall be delivered to Owner upon completion of the work.

B. Payments pursuant to partial payment will not be made if the record drawings are not kept current, and if the record drawings, showing all variations between the work as actually constructed and as originally shown on the Contract Drawings or other Contract Documents, have not been inspected by Owner.

C. Final payment will not be acted upon until Contractor has prepared and delivered complete, current record drawings to Owner. Said record drawings which must reflect all completed work, may be in the form of a set of prints with carefully plotted information overlaid in colored pencil.

1.08 Contractor's Requests for Information (RFIs)

Contractor may submit a Request for Information when it is necessary to obtain information or clarification regarding: requirements of Contract Documents, interpretation of Contract Documents, or apparent errors or omissions in Contract Documents. An RFI may also be submitted to state the Contractor's concern related to the omission or misapplication of a product,

or to call to Owner's attention a superior product based on the Contractor's expertise. Contractor is expected to use the RFI form attached to this Specification. Contractor is not responsible for the Owner's costs associated with evaluating and responding to an RFI; however, Owner will not review Contractor's RFIs that are in fact Requests for Changes (RFCs), as determined by Owner. In such cases, Contractor will be required to resubmit on the appropriate RFC form. See Part 1.09 herein. Contractor shall allow Owner up to thirty (30) working days to respond to Contractor's RFIs. As such, Contractor is expected to thoroughly review all applicable portions of the Contract Documents for which the work is contemplated well in advance of Contractor commencing the actual work. This will allow Contractor sufficient time to prepare the necessary RFIs and will allow Owner sufficient time to evaluate and prepare responses to same.

Within one week of receiving an RFI response from Owner, Contractor is required to notify Owner (in writing) if there are any cost or schedule impacts associated with Owner's response. Said notification shall be submitted as a Request for Change Order. All Requests for Change Order shall be submitted with proper justification and supporting documents, as determined by Owner. If no such advisement is made by Contractor, it will be understood that Contractor understands and accepts Owner's response, and that there are no cost or schedule impacts to the Contractor associated with same (even if the RFI response constitutes a change to the Contractor's scope of work).

1.09 Contractor's Requests for Change (RFCs)

Contractor may submit a Request for Change when Contractor proposes a change in the Contract requirements. All change requests shall be submitted on the RFC form attached to this Specification. As shown therein, Contractor is required to fully describe the benefit(s) to the Owner, benefit(s) to the Contractor, the cost and/or schedule impact(s) associated with the requested change, along with whether or not Contractor proposes or requires a Contract Change Order for implementing the change. Except for as described in Part 1.08 herein, any Contractor RFC that is submitted on the RFI form will be returned without review.

As noted on the RFC form, it is understood that certain RFCs can be responded to promptly, with minimal expenditures required by Owner. It is also understood that other RFCs require significant expenditures by Owner in order to properly evaluate and respond to Contractor's RFC. For those RFCs that fall in the latter category, Owner will provide an estimate (time and money) to Contractor as an initial response to RFC. Contractor may then elect to have Owner proceed with evaluating Contractor's RFC (with estimated value deducted from Contractor's Contract with Owner), or elect to withdraw Contractor's RFC.

1.10 Submission in Electronic Media Format

In addition to providing paper (i.e. hard) copies, all documents (RFIs, RFCs, Submittals, Change Order Requests, etc.) shall be submitted electronically.

A. General

Provide all information in searchable portable document file (PDF) format; PC compatible using Windows operating system as utilized by the Owner. All information provided shall be consolidated to one PDF in the latest version of Adobe Acrobat, with a Table of Contents and bookmarks for each major section (for each submittal). When required below (or if required otherwise by Owner), documents shall also be provided

electronically in Word format. If document exceeds the size in which Owner can receive by email (generally larger than 10 MB), the document shall be uploaded to the Owner's FTP site (if available), or saved onto a CD and transmitted to Owner.

B. Contractors using other software shall be required to provide to the Engineer conclusive evidence of 100 percent data transfer capability.

C. Shop Drawing Submittals

In addition to submitting four (4) hard copies of all shop drawing submittals (see Part 1.03 herein), Contractor shall submit shop drawing submittals electronically in PDF format (searchable from bookmarks). This applies to all text documents, manufacturer's literature, diagrams, and all graphic submittals. Provide one (1) PDF file using the latest version of Adobe Acrobat.

D. O&M Manuals

In addition to submitting six (6) hard copy sets of all O&M manuals (see Part 1.05 herein), Contractor shall submit six (6) copies of a single DVD containing the entire O&M manual in PDF format (searchable from Table of Contents and bookmarks).

E. RFIs, RFCs, Correspondence, and Change Order Requests

Provide electronic submission in Word and PDF format, plus one (1) hard copy. If required by Owner, provide one (1) CD (copy) containing the entire document with attachments.

SAMPLE
SHOP DRAWINGS/SUBMITTAL REVIEW COMMENT SHEET

Job No.: Date:

Project:

Owner:

Contractor:

Submittal No.: 15

Description: Vertical Turbine Pumping Units

COMMENTS:

Contractor shall **revise and resubmit** complete submittal addressing the following comments:

1. Vertical Turbine Pumping Units

   A. Per Parts 1.02.B.4 and 1.02.C.4 of Specification Section 11310, each fabricated steel discharge head shall be provided with an AWWA C207 Class E flanged base in lieu of proposed bottom plate.

   B. Although a +5% to +8% increase in total dynamic head is allowed by the Hydraulic Institute, the total dynamic head for each proposed pumping unit at the design flow rate shall be as specified in Parts 1.02.B.1 and 1.02.C.1 of Specification Section 11310. If said design condition causes the proposed motor to be overloaded (at 1.0 service factor) at any point on the pump performance curve, the pumping unit impellers shall be trimmed accordingly to reduce the motor load to non-overloading conditions (at 1.0 service factor).

   C. Although the pump cans will be provided by others, per Part 1.05 of Specification Section 11310 (Schedule A), the manufacturer shall verify the applicability of pumping equipment with respect to NSPHa, suction piping, pump can and discharge geometry to ensure prevention of cavitation, vibration, surging, overheating, corrosion, and vortexing. Refer to the Construction Drawings and piping/pump can fabrication drawings for suction and discharge piping and pump can information.

   D. Per Part 2.02.B of Specification Section 11310, pumping unit impellers shall be hydraulically balanced in addition to dynamically balanced.

   E. Per Part 3.02 of Specification Section 11310, the Contractor shall be responsible for installation. However, per Part 3.04 of Specification Section 11310, Contractor shall submit a letter to the Owner confirming that all pumping equipment was inspected, operation checked, and installation approved in writing by the pumping equipment supplier prior to operation of the equipment.

F. Per Part 3.03 of Specification Section 11310, the pump manufacturer's representative shall supervise the field acceptance testing and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

G. Per Part 3.03.A of Specification Section 11310, vibration of complete pumping unit as tested in the field shall not exceed 0.0025" peak to peak amplitude when operating. If said maximum vibration amplitude is exceeded, the pumping units shall receive a final field trim balance.

H. Pump performance curves were not submitted for proposed pumping units as required per Parts 1.03 and 1.04 of Specification Section 11310. Submitted curves are not legible. Submit pump performance curves full size on 8-1/2" (ordinate) x 11" (abscissa) paper for proposed pumping units including the following:

1) Shutoff head, head versus capacity, pump bowl efficiency versus capacity, and brake horsepower versus capacity, all for full operating range specified.

2) Certified values on each curve at all specified design points demonstrating compliance with the pumping unit requirements as outlined in Parts 1.02.B.1 and 1.02.C.1 of Specification Section 11310.

3) Arrows pointing to the limits of recommended stable operation between which pumps are to be operated to prevent surging, cavitation, and vibrations. Limits of operation shall be included on each speed curve provided for the FE/BWS pump.

I. Submitted pump manufacturer's brochure is for M Series Vertical Turbine Pumps. Submitted bill of materials, pump data sheets, pump dimensional sheets, and Operation and Maintenance manual indicate the proposed pumps are Model VIC. Submit data confirming that proposed pumps are either M Series or Model VIC. Submit manufacturer's brochure corresponding to the proposed pumps.

J. Per Parts 1.02.B and 1.02.C of Specification Section 11310, pumping units shall operate with suction can pressure ranging from 0 to 5 psi. Submitted hydraulic analyses indicate the pump is suitable for operating with suction can pressure of 0 psi. Submit data indicating that pumping units are suitable for operation within the specified suction can pressure range.

K. The FE/BWS pump discharge head shall be provided with a 36" Class E flanged base (46" O.D.) to match the approved pump can fabrication drawings in lieu of proposed 48.75" O.D. bottom plate.

L. Per Part 1.02.C.4 of Specification Section 11310, the discharge head for the RCW unit shall be provided with the dimensions shown on the Construction Drawings. The dimension shown on the Construction Drawings from the bottom of the discharge head base flange to the centerline of the discharge is 26-1/12". Submitted dimensional drawing for the RCW pump discharge head indicates this dimension will be 27". Revise drawings to include the required 26-1/2" dimension.

M. Per Part 2.02.A of Specification Section 11310, the pump bowls shall be lined with vitreous porcelain enamel in lieu of submitted epoxy. Per submitted manufacturer's vertical turbine pump brochure, glass-lined cast iron bowls is a standard design feature. Submit manufacturer's product data sheets on glass lining in lieu of epoxy coating.

N. Per Part 2.02.A of Specification Section 11310, the pump bowls shall be of Class 30 (or better) cast iron and have minimum tensile strengths of 30,000 psi. Submit data verifying same.

O. Per Part 2.02.B of Specification Section 11310, the pump impellers shall be of the enclosed type. Submit data verifying that proposed impellers are of the enclosed type.

P. Per Part 2.02.H of Specification Section 11310, the strainer shall be provided with cross vanes for vortex suppression. Submit manufacturer's product data sheets for proposed strainer verifying same.

Q. Per Parts 1.02.B.8 and 1.02.C.8, basket strainer shall be attached to pump with stainless steel fasteners. Submit data indicating same.

R. Per Parts 1.02.B.6, 1.02.C.6, and 2.02.J of Specification Section 11310, the top shaft shall be two-piece with a coupling accessible within the pump discharge head. Said coupling shall be flanged. Submit manufacturer's data sheets for required coupling.

S. Nameplate data was not provided with submittal. Submit proposed nameplate for pumping units per Part 2.04 of Specification Section 11310.

T. Manufacturer's proposal to provide John Crane Type 1 mechanical seal in lieu of specified John Crane Type 21 mechanical seal is acceptable. However, resubmit manufacturer's product data sheets for proposed mechanical seal clearly delineating the proposed materials of construction. Provide drawing detail of mechanical seal as installed in discharge head, including all necessary piping and drain line to pump can.

U. Proposed Tnemec N140 epoxy coating is accepted for coating the pump head and column.

2. <u>Vertical Hollow Shaft Electric Motors</u>

A. Although proposed motors will be balanced to limit the vibration to 0.08 inches per second, the total vibration for the assembled pumping unit as tested in the field shall not exceed 0.0025" peak to peak amplitude when operating.

B. Per Part 2.06.N of Specification Section 11310, the lubrication system shall have sufficient oil storage and cooling capacity to limit the oil bath temperature rise to 45° C above 40° C ambient temperature. Proposed exception states that Emerson's standard oil bath temperature rise will be provided. Submit data for Emerson's standard oil bath temperature rise design.

C. Manufacturer's statement that motors will be provided with "Emerson standard oversized main conduit box" is unacceptable. Per Part 2.06.R of Specification Section 11310, motors shall be equipped with extra-large heavy duty split type conduit boxes. Manufacturer's catalog information indicates that conduit boxes one size larger than standard are available for vertical hollow shaft motors. Submit manufacturer's product data sheets indicating proposed motors will be provided with required conduit boxes.

D. Proposed 7.5 hp TEFC motor shall be provided with drain and breather elements (brass construction). Submit written confirmation of same.

E. The requirements set forth in Specification Section 16150 do not apply to the proposed vertical hollow shaft motors; therefore, the submitted exceptions to same are not necessary.

F. Submitted data sheets for the FE/BWS pumping unit motor include an 1,800 rpm motor. Per submitted pumping unit data and Part 1.02.B.1 of Specification Section 11310, a 1,200 rpm motor is required for said pumping unit. Submit manufacturer's product data sheets for required motor.

G. Submitted data sheets for the proposed motors include an ambient temperature rating of 40° C (104° F). Per Item 10 of the Supplemental Special Requirements, all equipment shall be designed for maximum ambient temperature of 120° F. Submit revised motor data sheets demonstrating that motors will be provided with required temperature rating suitable for continuous operation at 120° F ambient temperature.

H. Per Part 2.06.L of Specification Section 11310, motors shall be equipped with angular contact ball thrust bearings. Submit data verifying required bearings will be provided. Submit motor thrust capacity for one year L-10 minimum life.

I. Per Part 2.06.O of Specification Section 11310, motor thermal protection shall be set to open control circuit at 135° C. Submit data verifying same. Contractor shall coordinate installation of motor thermal control modules (Siemens Thermasentry) to be provided by the motor manufacturer with the MCC manufacturer for mounting in the respective bucket.

J. Not all nameplate data required per Part 2.06.T of Specification Section 11310 is included in submitted motor nameplate data. Resubmittal shall include all the requirements as set forth in the Specification for each proposed pumping unit, including connection nameplate data per Part 2.06.T.2 and bearing nameplate data per Part 2.06.T.3 of Specification Section 11310.

K. Proposed motors for the RCW pumping units are not required to be inverter duty.

L. Submit replacement parts list for proposed FE/BWS pump motor, similar to submitted replacement parts list for proposed RCW motor.

M. Submitted manufacturer's motor brochure is for Weather Protected Type 1 vertical motors. The proposed motor for the RCW pumping unit is Totally Enclosed Fan Cooled (TEFC). Submit manufacturer's product brochures for TEFC motors.

FOR ADDITIONAL COMMENTS, SEE THE FOLLOWING SHEETS AND/OR DRAWINGS:

N/A

☐ ACCEPTED	☐ REJECTED
☒ REVISE AND RESUBMIT	☐ FURNISH AS CORRECTED
☐ SUBMIT SPECIFIED ITEMS	☐ _____

Corrections or comments noted on shop drawings do not relieve contractor of responsibility to comply with Contract Documents. Shop drawing review is hereby performed only to verify general compliance with the Contract Documents and general conformance with the design concept.

Date: _____ By: _____

EQUIPMENT MAINTENANCE DATA SHEET

PREVENTIVE MAINTENANCE PROGRAM	**EQUIPMENT RECORD NUMBER**		
EQUIPMENT DESCRIPTION	**ELECTRICAL OR MECHANICAL DATA**		
Name:	Nameplate Horsepower:		
Serial No.:	Model:		
Vendor:	Catalog Number (polyphase motors):		
Vendor Address:	Type:		
	Manufacturer:		
Vendor Rep:	Voltage:	Measured Current:	Nameplate Current:
Phone:	Phase:	Overload Relay Setting:	rpm:

MAINTENANCE AND LUBRICATION WORK TO BE DONE	Frequency*

SPARE PARTS LIST		**FUSES/LAMPS/SEALS**		
Quantity	Part & Part Number	Qty	Size	Type & Ordering Description

WARRANTY AND OPERATING REQUIREMENTS AND REFERENCE

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly; S - Semiannually; A - Annually

SAMPLE
EQUIPMENT MAINTENANCE DATA SHEET

PREVENTATIVE MAINTENANCE PROGRAM	EQUIPMENT RECORD NUMBER		
EQUIPMENT DESCRIPTION	**ELECTRICAL OR MECHANICAL DATA**		
Name: Influent Pump No. 1 Tag No.: P01-1	Nameplate Horsepower: 15 HP		
Serial No.: 123456ABC	Model: 140T Frame Serial No. 987654ZY Class F Insulation w/ Space Heater		
Vendor: ABC Pump Co.	Catalog Number (polyphase motors): M36999b		
Vendor Address: 1234 Richter Avenue Irvine, CA 92604	Type: Vertical Turbine Pump, Model VTR14 with 3 stages, impeller 147, and 12 1/2" trim.		
	Manufacturer: DEF Motors, Inc.		
Vendor Rep: XYZ Equipment, Inc.	Voltage: 460	Measured Current: 18 amps	Nameplate Current: 20 amps
Phone: 949-752-0505	Phase: 3	Overload Relay Setting: 25 amps	rpm: 1,800

MAINTENANCE AND LUBRICATION WORK TO BE DONE	Frequency*
1. Operate valves and check such things as a) bearing temperature, b) changes in running sound, c) suction and discharge gage readings, d) pump discharge rate, and e) general condition of the drive equipment.	D
2. Check packing.	D
3. Check pumping unit for any dust, dirt or debris.	W
4. Lubricate bearing frame and motor bearings (consult manufacturer's instructions for type of grease or oil).	Q
5. Disassemble and change or repair the following: a) impeller, b) shafts, c) shaft sleeve, d) rotary seals, and e) sleeve bearings.	A

SPARE PARTS LIST		FUSES/LAMPS/SEALS		
Quantity	Part & Part Number	Qty	Size	Type & Ordering Description

WARRANTY AND OPERATING REQUIREMENTS AND REFERENCE

For manufacturer's instructions regarding installation, operation, maintenance and troubleshooting of this equipment, see Volume ____, Section ____.

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly; S - Semiannually; A - Annually

SAMPLE

CONTRACTOR'S REQUEST FOR INFORMATION (RFI) #_____

To (Engineer):	
From (Contractor):	
Subject:	
Reference: Construction Drawing:	Specification (Section and Page):
REQUEST	
Information is requested as follows:	
Information Requested By (Name):	**Date**:
Response Requested By (Date):	
Received by Krieger & Stewart (Date):	
RESPONSE	
Response to Information Request:	
Response By (Name):	**Date**:

Final Distribution:

SAMPLE

CONTRACTOR'S REQUEST FOR CHANGE (RFC) #_____

To (Engineer):	
From (Contractor):	
Subject:	
Reference: Construction Drawing:	Specification (Section and Page):
REQUEST	
The following change is requested:	
Change Requested By (Name):	**Date**:
Response Requested By (Date):	
Received by Krieger & Stewart (Date):	
Benefit to Owner:	
Benefit to Contractor:	
Cost and/or Schedule Impact:	
Change Order Required or Proposed? ____ YES ____ NO	
RESPONSE	
Response to Change Request: (1)	

RESPONSE (Continued)	
Response By (Name):	**Date**:

(1) It is understood that certain RFCs can be responded to promptly, with minimal expenditures required by Owner. It is also understood that other RFCs require significant expenditures by Owner in order to properly evaluate and respond to Contractor's RFC. For those RFCs that fall in the latter category, Owner will provide an estimate (time and money) to Contractor as an initial response to RFC. Contractor may then elect to have Owner proceed with evaluating Contractor's RFC (with estimated value deducted from Contractor's Contract with Owner), or elect to withdraw Contractor's RFC.

Final Distribution:

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SECTION 01500
PRE-STARTUP, STARTUP, AND INTIAL OPERATION TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 Description

The Contractor shall furnish all labor, equipment, and material necessary to perform pre-startup, startup, and initial operation for Well No. 1 and all related appurtenances.

1.02 Pre-Startup, Startup, Field Testing, and Initial Operation Plan

Contractor shall submit a complete Pre-Startup, Startup, Field Testing, and Initial Operation Plan to the District a minimum of 30-days prior to scheduling pre-startup activities. The plan shall include a schedule, a list of all equipment that will be tested, and complete testing procedures demonstrating compliance with this Specification, other portions of the Contract Documents, and equipment manufacturers requirements. As a minimum, testing procedures for all equipment shall include field test data log sheet for recording the test equipment, the compliance values, and the actual field measurements. Contractor shall coordinate with the appropriate manufacturers to incorporate testing requirements for equipment furnished. In addition, testing procedures at a minimum shall define required instrumentation to test the equipment and describe how the equipment will be tested in order to determine compliance with the Specification requirements and recognized standards of the industry.

1.03 Pre-Startup

A. Upon completion of equipment installation, including all associated mechanical, electrical, instrumentation and control work, Contractor shall submit manufacturer's certificate of proper installation and Contractor's certification reports. Prior to energizing equipment, manufacturer's certificate of proper installation and Contractor's certification reports shall be submitted to the District for approval. Submittal shall be provided in accordance with Specification Section 11005.

B. Prior to scheduling startup and energizing equipment, Contractor shall submit the following information:

1. Startup, Field Testing, and Initial Operation Plan as specified in Part 1.02 herein.

2. Manufacturer's certificate of proper installation for the following equipment:

Equipment	Technical Specification Section
Deep Well Vertical Turbine Pumping Unit	11320, 11325

3. Contractor's certification reports.

C. After the items listed in Part 1.03B herein have been approved by the District, Contractor shall provide seven (7) days advance notice to the District prior to commencing pre-startup activities. Contractor shall allow time in his schedule after pre-startup to correct deficiencies and for confirmation of their correction by the District prior to scheduling

startup. Contractor shall coordinate with the Electrical Subcontractor and pump manufacturer.

D. Prior to commencing startup activities, Contractor shall submit to the District for approval written confirmation from each equipment manufacturer that all required pre-startup checks and tests have been successfully performed and the equipment is ready for startup and operation.

1.04 Startup and Field Testing

A. General

Upon District approval of the pre-startup submittals listed in Parts 1.03A and 1.03D herein, Contractor may proceed with startup, field testing, and initial operation. Contractor shall provide all labor, equipment, and material for startup, field testing, and initial operation.

B. Startup

During startup, all pump equipment shall be operated and initially calibrated and tested. Contractor shall be responsible for startup of the equipment he furnished and installed, and shall have equipment representatives on site during the startup and initial operation. Defects in equipment or defective installation of equipment shall be immediately corrected by the Contractor.

C. Field Testing

1. General

Contractor shall provide all labor, materials, supplies, and instruments required for equipment field tests specified hereinafter. Contractor shall record and assemble all field data and submit six (6) copies of same to District for review and approval.

Equipment shall be field tested in accordance with the General Provisions, Special Conditions, and Technical Specifications, and as specified herein. The District's analysis of the field test data will determine the acceptability of the equipment. If the equipment does not perform in conformity with Contract Document requirements and/or District approved certified test data, the Contractor will be required to remove, replace, and restore the equipment to full compliance with the Contract Documents at his expense.

2. Well Pump

Following completion of the installation and satisfactory pre-startup of the equipment, the Contractor shall provide the services of the well pump manufacturer's representative to assist and coordinate operation and testing of the well pump. The well pump shall be tested and performance results shall be recorded. At each test condition, Contractor shall record water level, discharge pressure, flow rate, motor amperage, motor voltage, and power.

Upon completion of field testing, Contractor shall submit a written report summarizing all field test data and comparing the field test results to the manufacturer's stated performance values and Specification requirements.

If, in the opinion of District, the equipment furnished does not perform in accordance with these Specifications, Contractor shall promptly make all necessary repairs or corrections so that the equipment fully complies with these Specifications. Contractor shall remove, restore, and replace the equipment if required. Factory and field performance tests shall be rerun as directed by the District. Pump manufacturer's representative shall assist District in the proper conduct of the above field acceptance tests.

1.05 Initial Operation (2 Days)

Upon acceptance of startup and field testing, Contractor shall place the well pumping plant into full automatic operation and operate the system and all associated facilities for a minimum of two (2) consecutive days to demonstrate that the facilities operate as a complete, functional facility and meets the requirements of the Contract Documents. Any defects in materials or workmanship which appear during the initial operation shall be immediately corrected by the Contractor. Time lost for repairs or adjustments which interrupt the initial operation shall extend the initial operation period until the District is satisfied that the facility functions properly.

1.06 Live Test (7 Days)

Upon acceptance of the initial operation demonstration, Contractor shall commence a full 7-day "live test" under actual conditions. District will operate the facilities and Contractor shall provide personnel to be onsite (or available within one hour) to repair or correct any deficiencies. If any problems need to be corrected, fixed or modifications are performed during the test period, the test shall start over. All costs for repairs/replacement are the responsibility of the Contractor. All warranties for labor, equipment, and materials shall begin on the date of acceptance of the 7-day test. An acceptance letter will be written by the District to the Contractor, acknowledging successful completion of the 7-day test.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

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SECTION 02520
WELL REHABILITATION

PART 1 - GENERAL

1.01 Scope of Work

A. The Contractor shall furnish all labor, equipment, materials, and services to rehabilitate existing Well No. 1, including (but not limited to) brushing, chemical treatment (cleaning), cleaning (bailing) debris from the bottom of the well, video logging, disinfection, purging, surging, neutralizing well wastewater, sampling, and testing as specified herein and in the Contract Documents. Contractor is advised that existing pumping unit has already been removed from Well No. 1 and a video log has already been performed and is available for viewing, upon request by the Contractor.

B. Unless specified otherwise, well rehabilitation shall occur in the following order: 1) wire brush well, 2) remove fill and debris material from well, 3) perform video log, 4) chemically treat well, 5) wire brush well and remove debris, 6) perform video log, 7) disinfect well, and 8) install pumping unit

C. Contractor may submit in writing to Owner alternative materials and methods for rehabilitating the well, such as the use of available proprietary materials. Alternative methods may only be used if approved by Owner in advance of bid opening by issuance of a Contract Addendum.

1.02 Specific Project Requirements

The well shall be rehabilitated as specified herein. The following Specific Project Requirements shall supplement or override (as applicable) the requirements of Part 2 and Part 3 of this Section:

A. Well Construction

Total Well Depth:	1,220' BGS (below ground surface)
Well Casing Inside Diameter:	16"
Well Casing Thickness:	5/16"
Perforations:	Wire Wrap (0.55" opening)
No. of Perforated Sections:	One (1)
Perforation Location(s):	900' BGS to 1,200' BGS
Static Water Level:	740' BGS

B. Existing Well Pumping Unit: None - Pumping unit has been removed from well.

C. One (1) well volume = 5,000 gallons

D. Normal (target) pH = 6.5 or greater

E. Two (2) color video logs shall be provided for the well; one after initial bailing operation and one after chemical cleaning.

F. Wire brush bristles shall be constructed of nylon and wire brushing method shall be rotary method.

H. Chemical Treatment (Cleaning) of Well

1. Chemical treatment volume = 7,500 gallons (including one (1) well volume)

2. Chemical treatment solution shall be composed of the following:

a. Hydrochloric acid (approximately 30% activity): 9% of chemical treatment volume (675 gallons)

b. Biodispersant: 3% of chemical treatment volume (225 gallons). Biodispersant shall be Johnson Screens NW-310, no substitutes.

c. Nonionic surfactant (Johnson Screens NW-400 or equivalent): 0.1% of chemical treatment volume (7.5 gallons)

d. Potable water: 40% of chemical treatment volume (3,000 gallons).

1.03 Submittals

Contractor shall submit complete submittals (shop drawings) in accordance with Specification Section 01300, "Contractor Submittals". Submittals shall include, but shall not be limited to, the following:

A. Manufacturer's product data, instructions, Certificates of Analysis (COS), NSF 60 certification documentation, and material safety data sheets (MSDS) for all well treatment and neutralization chemicals.

B. Manufacturer's product data, written descriptions, and drawings for all equipment, including (but not limited to) bailing equipment, surging equipment, injection equipment, neutralization equipment, video scanning equipment, and instrumentation.

C. Contractor's proposed program for applying the chemicals, methods of neutralizing chemicals and wastewater, methods of disposal, Emergency Response Plan, list of staff qualified to handle the specified chemicals, and training and certifications received by each individual pertinent to their duties.

D. Manufacturer's product data, written descriptions, method of use, and shop drawing of all tools and equipment.

F. Written descriptions of all proposed methods and procedures.

G. Video logs.

H. All items, data, reports, notifications, etc. required to be provided or submitted as described in this Specification Section.

PART 2 - PRODUCTS

2.01 Video Logging of Well

The successful bidder will provide two (2) color video logs for the well; one before and one after rehabilitation. The Contractor shall provide equipment that is capable of producing a clear video image of the well casing both submerged and out of the water. The camera must be capable of providing a clear video image of the Well and must be capable of displaying a right angle, side-scan view of the Well casing at the direction of the Owner. The equipment shall indicate digitally on screen the depth of the camera within one (1) foot of its actual location at one-foot intervals. The Owner must be present during the video scan. The successful bidder will provide a written field log of the observations from each video scan. A DVD or VHS videotape of each inspection scan shall be provided to the Owner upon completion of each video-logging run. The successful bidder will schedule the video loggings with the Owner at least two (2) Working Days in advance. Prior to performing videologs, water shall be added to the well in sufficient quantity and for sufficient duration to clarify the water in the well.

2.02 Bailing Well Clean

Contractor shall remove the debris from the bottom of the Well using a bottom bailer or an Owner-approved bailing method to depths specified for the Well.

2.03 Wire Brushing of Well

The well shall be cleaned using a **rotary brush method**. The brush shall be a minimum of five (5) feet in length and have 100% contact for the length of the brush with the well casing. The brush shall turn no less than ten (10) revolutions per minute. The rate of brushing shall be no more than forty (40) feet per hour. The bristle material shall be manufactured of nylon. As the well casing is cleaned, the scale and encrustation being removed will be allowed to settle to the bottom of the Well. Actual method and tool must be submitted to the District for approval prior to the start of work. The successful bidder is responsible for safely controlling all fluid and debris around and exiting the site.

2.04 Chemical Treatment of Well

A. All chemicals used in treating the well shall be of food-grade quality. All biodispersants, surfactants and additives, both proprietary and non-proprietary, shall be NSF 60 certified for potable water well use.

B. Contractor shall furnish all labor, equipment, materials, and services to chemically treat the well. Care shall be taken to follow all Federal, State, and local regulations pertaining to the handling and disposal of the waste chemicals.

C. Prior to commencing the Work, Contractor shall supply to the Owner a copy of the manufacturer's Material Safety Data Sheets (MSDS) for all well treatment and neutralizing chemicals for the Owner's approval and a shop drawing of the snug fitting double surge block assembly. A Certificate of Analysis (COA) from the manufacturer/supplier must be provided for the acid used. In addition, the Contractor shall provide their proposed program to apply the chemicals, method of neutralizing the acid, method of disposal, Emergency Response Plan, and list of staff qualified to handle

the above chemicals. Said list shall include training and certifications received by each individual pertinent to their duties.

All individuals involved in handling well treatment chemicals shall possess all certifications, authorizations and licenses required by local, state and federal authorities to perform the work.

D. Contractor shall chemically treat the well utilizing the method specified below.

1. The well shall be pretreated to disrupt the fouling mechanisms existing within the well column. Pretreatment shall consist of wire brushing of the entire wetted portion of the well as specified herein, followed by bailing the well clean.

2. A treatment solution consisting of the following chemicals shall be mixed above-ground and injected into the existing perforated sections of the casing starting from the bottom of the lower perforated casing to the top of the perforated casing using a double packer tremie method:

    a. Hydrochloric acid (approximately 30% activity): 9% of Total Well Volume
    b. Biodispersant (Johnson Screens NW-310, no substitutes): 3% of Total Well Volume
    c. Nonionic surfactant (Johnson Screens NW-400 or equivalent): 0.1% of Total Well Volume

2. Total Well Volume shall mean 1.5 X the volume of standing water within the well casing.

3. Immediately following the injection of the treatment solution, the Contractor shall swab the perforated sections of the casing with a minimum 20 foot long, snug fitting double surge block. Swabbing shall begin at the bottom of the lower perforated casing and work continuously upwards to the top of the upper perforated casing. After the upper most portion of the well is swabbed, Contractor shall secure a water sample to verify the pH. The sample may be secured by air lifting, submersible pumping, or thief sampling. **If the pH is above three (3), additional treatment solution will be added to the well at the discretion of the Owner**. If additional treatment solution is needed, the solution will be added and swabbed into place using the double surge block. Sampling and treatment solution addition shall continue until pH is equal to three (3) or less.

4. Contractor shall them wore-brush the well as specified in Section 2.05 above.

5. The well will then be allowed to stand for 12 hours. Immediately after 12 hours the Contractor shall swab each 20 foot perforated section for 15 minutes with the double surge block. Swabbing shall begin at the top of the upper perforated casing and work continuously downward to the bottom of the lower perforated casing.

E. Contractor shall remove and dispose of the treatment chemicals as outlined below.

1. After completion of swabbing as described above, the Contractor shall remove five (5) volumes of wastewater from the well into an above-ground portable tank, such as a Baker Tank. The wastewater will be removed continuously from the well by air lifting or pumping. Air lifting or pumping shall begin at the bottom of the well and work upward to the top of the upper perforated casing interval. The well should be continually purged until the pH has stabilized to a normal background level and the turbidity of the discharge has dissipated.

2. At the discretion of the Owner, water samples will be secured from the well after removal of the treated water to determine pH after removal. The total number of samples will not exceed four (4) in order to determine pH. Should the pH be greater than nine (9) or less than six (6), the Contractor will remove additional wastewater from the well at the direction of the Owner and dispose of same.

3. After removal of the wastewater, and at the direction of the Owner, Contractor shall bail the well clean.

4. Prior to disposal, Contractor shall neutralize the pH of the wastewater in the above-ground tank by adding sufficient soda ash (powder), magnesium hydroxide (slurry), potassium hydroxide (liquid), or other pre-approved neutralizing agent. **Neutralization will not be allowed in the well casing**.

5. All wastewater and residual solids from chemical treatment shall be disposed of by the Contractor in a manner and at the facility designated by the Contractor and approved by the Owner, in accordance with the attached Scope of Work.

6. Contractor shall discharge the neutralized wastewater onsite at a controlled rate to avoid erosion, as directed by Owner.

F. Contractor has the option of submitting in writing to Owner alternative methods of chemically treating the well, such as the use of available proprietary chemical well treatment systems. Alternative methods may only be used if approved by Owner in advance of bid opening by issuance of a Contract Addendum.

G. All chemicals used in treating the well shall be of food-grade quality. All biodispersants, surfactants and additives, both proprietary and non-proprietary, shall be NSF approved for potable well use.

2.05 Well Disinfection

Unless specified otherwise, disinfectant shall be 12.5% trade weight, filtered sodium hypochlorite solution yielding approximately one (1) pound of free chlorine per gallon of solution. Sodium hypochlorite solution shall not have been stored more than 60 days.

After wire brushing and removal of debris, the well shall be disinfected with a chlorine solution. Unless otherwise permitted, Contractor shall use the following procedure to disinfect the well:

a. Before dosing, the Contractor shall check the pH of the well to determine if buffering of the chlorine will be necessary. If the pH is above 7.5 a chlorine enhancing chemical such as Johnson Screen's "NW-410," Layne-Christensen's "Oximate," or other Owner pre-approved equivalent must be used to lower the pH and enhance the effectiveness of

chlorination. The chlorine enhancing chemical shall be used at a rate of 1.5 gallons per 1,000 gallons of disinfectant solution for a target pH of 6.5 to 7.5 during chlorination.

b. Contractor shall prepare a disinfectant solution consisting of water, sodium hypochlorite solution, and, if necessary, chlorine enhancing chemical, above-ground for addition to the well. The disinfectant solution shall have a free chlorine concentration of 300 parts per million (ppm). To achieve 300 ppm of chlorine, approximately 2.4 gallons of 12.5% Sodium Hypochlorite solution will be required per 1,000 gallons of disinfectant solution. The sodium hypochlorite solution used shall not have been stored more than 60 days.

c. Contractor shall dose the well by adding two times the Well Casing Volume of disinfectant solution to the well. The method used to introduce the disinfectant solution into the well shall ensure that the disinfectant solution reaches all portions of the well in which contamination might have occurred during construction.

d. Immediately after dosing the well, Contractor shall agitate the chlorinated water within the well by swabbing the well.

e. After the well has been swabbed, Contractor shall secure a water sample to verify the chlorine concentration. The sample may be secured by air lifting, submersible pumping, or thief sampling. If the chlorine concentration is less than 100 ppm, additional disinfectant solution will be added to the well, at the discretion of the Owner. Sampling and disinfectant solution addition shall continue until the chlorine concentration is between 100 and 300 ppm. **A chlorine concentration of greater than 500 ppm is not permitted.**

f. Contractor shall repeat the agitation, sampling, and disinfectant solution addition procedure twice at one hour intervals.

g. Contractor shall then allow the well to stand without pumping or agitation for at least 6 hours.

h. Contractor shall then reinstall the permanent pumping unit into the well, and shall pump the chlorinated water from the well into an above-ground portable tank, such as a Baker Tank until chlorine is no longer evident and shall continue to pump until 15 minutes thereafter.

i. Contractor shall then allow the well to stand without pumping or agitation for 24 hours prior to sampling.

j. Contractor shall then secure two samples of water from the well in approved containers, and have said samples analyzed by a State Certified analytical laboratory for total coliform (presence/absence), fecal coliform (presence/absence), and heterotrophic plate count. Contractor shall secure the first sample within five minutes of starting the pump at the specified pumping rate, and the second sample thirty minutes thereafter. Contractor shall furnish results of said analyses to Owner within 48 hours of sampling. Contractor shall perform all procedures and provide all tests and analyses at his own expense.

k. The well shall be deemed properly disinfected only if the sample analysis results indicate absence of total coliform bacteria, absence of fecal coliform bacteria, and a heterotrophic plate count of less than 500 colony forming units per milliliter (CFU/ml).

l. If the sample analysis results do not indicate that the well was properly disinfected, the Contractor shall repeat the entire disinfection procedure, including sampling, sample analysis, and reporting of sample analysis results. Contractor shall continue to repeat the entire disinfection procedure until sample analysis results indicate that the well has been properly disinfected.

m. The chlorinated water shall be dechlorinated to less than 0.1 ppm of chlorine prior to disposal. Dechlorination shall take place within the above-ground portable tank. The dechlorinated water shall be discharged onsite at a controlled rate to avoid erosion, as directed by Owner.

2.06 Surge Block/Swab

A. Surge block/swab shall be snug-fit, single or double disc (as specified in Part 3 herein). Double surge blocks/swabs shall have a minimum length of 20 feet.

B. Surge block/swab shall be constructed similar to Wire Line or Cable Tool Swab or Air System Development Tool per Standard Drawing RW-6, "Consolidation and Development Tools", included at the end of this Specification Section.

PART 3 - EXECUTION

3.01 General

1. All work shall be performed in accordance with all applicable Federal, State, and local laws and regulations.

2. Contractor shall safely control all fluid and debris around and exiting the site.

3.02 Time Records

A. The time required for pumping unit removal, bailing, wire brushing, chemical treatment, surging, chemical development, development pumping, and production testing will be recorded by the hour with one-half hour interval as the smallest unit of time credited to the Contractor. Fractions of an hour less than one-half hour, but exceeding one-quarter hour, will be recorded as one-half hour. The time to be recorded for bailing, wire brushing, chemical treatment, surging, chemical development, development pumping, and production testing shall commence when the equipment is installed in the well and is placed in operation, and shall end when equipment is stopped at the direction of the Owner.

B. No time will be credited for delays resulting from: (1) equipment stuck in the hole; (2) equipment breakdown; (3) arranging pumping or testing apparatus; (4) failure to conduct the operations in a diligent and workmanlike manner by which the desired results could ordinarily be expected.

3.03 Video Logging of Well

A. Video scanning shall not take place without Owner present.

B. Contractor shall schedule the video loggings with the Owner at least two (2) working days in advance.

C. Prior to performing video logs, potable water shall be added to the well in sufficient quantity and for sufficient duration to clarify the water in the well.

D. Contractor shall provide a written field log of the observations from each video scan.

E. A digital storage device of each inspection scan shall be provided to the Owner upon completion of each video-logging run.

3.04 Removal of Fill Material/Debris from Well

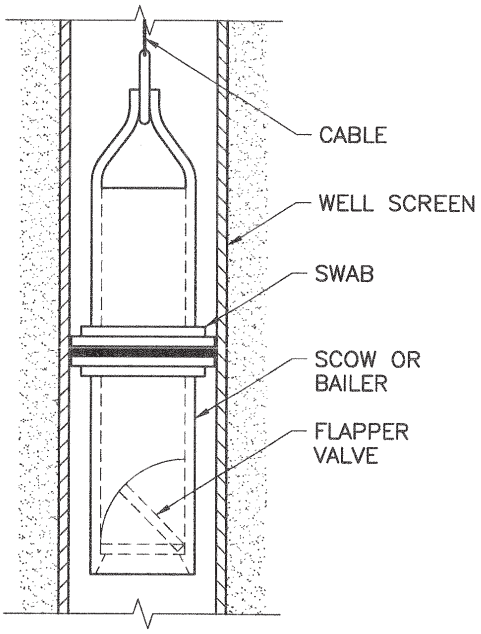
1. Contractor shall remove the fill material/debris from the bottom of the well using a bottom bailer, air lifting, or an Owner-approved removal method to the construction/design depth of the well.

2. Contractor shall measure the achievable depth of the well before and after material/debris removal.

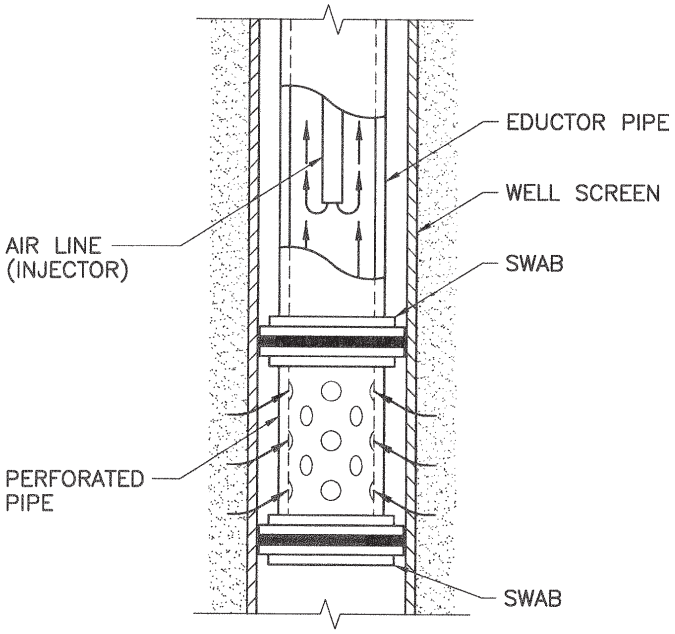
3.05 Cleanup

Contractor shall clean and restore all areas occupied by him in connection with the Work to preconstruction condition. Cleanup shall include, but shall not be limited to, removal and disposal of equipment, rubbish, excess materials, temporary structures, deposited sediments, and excavated materials and restoration of equipment, fences, pavements, trees, shrubs, piping, and ground surface. All parts of work site shall be left in a neat and presentable condition, all to satisfaction of Owner.

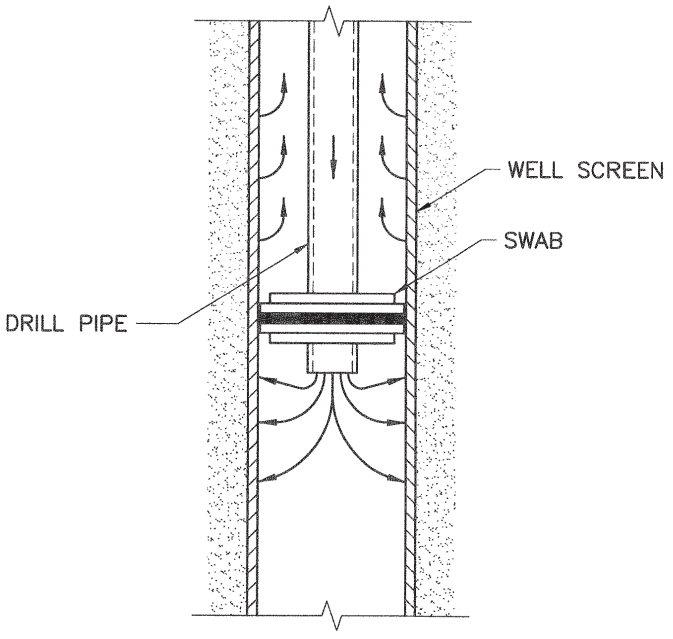
END OF SECTION
(Following Standard Drawing RW-6)



WIRE LINE OR CABLE TOOL SWAB



AIR SYSTEM DEVELOPMENT TOOL



CIRCULATION/CONSOLIDATION TOOL

DATE: MARCH 1998	KRIEGER & STEWART INCORPORATED	
	CONSOLIDATION AND DEVELOPMENT TOOLS	
REVISION	BY	DATE
	STANDARD DRAWING RW-6	

SECTION 09900
BASIC COATING AND PAINTING SPECIFICATION FOR WATER AND WASTEWATER FACILITIES

PART 1 - GENERAL

1.01 Scope

A. The work included in this section consists of furnishing all labor, materials, apparatus, scaffolding and all appurtenant work in connection with coating and painting, as indicated on the drawings and as specified herein.

B. In general, the following surfaces are to be coated or painted:

1. Exposed piping and other metal surfaces, interior and exterior.

2. All submerged and intermittently submerged metal surfaces, except stainless steel.

3. All structural and miscellaneous steel, including tanks.

4. The interior of wet wells, manholes, junction structures, headworks, and similar structures.

5. All exterior above ground concrete and masonry.

6. The interior of certain structures as specified in the Painting and/or Coating Schedule.

7. Equipment furnished with and without factory finish surfaces.

8. Doors, frames, woodwork and architectural trim work.

C. The following surfaces shall not be coated or painted unless shown or specified herein, or elsewhere in the Contract Documents.

1. Stainless steel.

2. Equipment nameplates, machined surfaces and grease fittings.

3. Non-ferrous and galvanized ferrous metal, including: (a) floor gratings, plates and frames, (b) handrailing, (c) stair treads, stringers and supports, (d) ladders and supports, (e) chain link fencing and appurtenances, (f) conduits.

D. In no case shall any concrete, wood, metal or any other surface requiring protection be left uncoated or unpainted, even though not specifically defined herein.

1.02 Reference Specifications and Standards

Without limiting the general aspects of other requirements of these specifications, all surface preparation, coating and painting of surfaces shall conform to the applicable requirements of the

American Society for Testing and Materials (ASTM), the National Association of Corrosion Engineers (NACE), the Society of Protective Coatings (SSPC), the American Concrete Institute (ACI) , the Forest Products Research Society (FPRS), the International Concrete Repair Institute (ICRI), and the manufacturer's printed instructions.

In the event of a conflict between codes, reference standards, drawings, and these specifications, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Owner for clarification and direction prior to ordering or providing any materials or labor.

1.03 Painting Subcontractor

Where protective coatings are to be performed by a subcontractor, said subcontractor must possess a valid state license as required for performance of the painting and coating work called for in this specification and shall have a minimum of five years practical experience and successful history in the application of specified products to surfaces and facilities of water and wastewater treatment facilities. Upon request, he shall substantiate this requirement by furnishing a list of references.

1.04 Shop Drawing Submittals

For each coating system to be used, the Contractor shall submit for Owner's review and approval the following data:

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

2. Paint manufacturer's instructions and recommendations on surface preparation and application.

3. Samples of colors and finishes available for each product. Where custom mixed colors are specified (e.g. to match colors of existing coated surfaces), the submitted color samples shall be made using color formulations prepared to match the color samples furnished or specified by the Owner. The color formula shall be provided with each color sample.

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

5. Material safety data sheet for each product used.

1.05 Quality Assurance

A. <u>Surface Preparation</u>

Surface preparation will be based upon comparison with "Pictorial Surface Preparation Standards for Painting Steel Surfaces", SSPC-Vis 1 ASTM Designation D220; "Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces", SSPC-Vis 2 ASTM Designation D610; Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive", NACE Standard TM-01-70; and as described below. Anchor profile for prepared surfaces shall be measured by use of a non-destructive instrument such as a Keane-Tator Surface Profile Comparator.

To facilitate inspection, the Contractor shall on the first day of sandblasting operations, sandblast metal panels to the standard specified. Plates shall be 1/8" (3.75 mm) plate stock and shall measure a minimum of 8-1/2" x 11" (216 mm x 280 mm). After mutually agreeing a specific panel meets the requirement of the specification, it shall be initialed by the Contractor and Inspector and securely sealed in clear plastic with desiccant to prevent rusting. Panels shall be prepared for each type sandblasting specified and shall be utilized by the Inspector throughout the duration of sandblasting operations.

B. Coating and Painting Application

No coating or paint shall be applied: when the surrounding air temperature or the temperature of the surface to be coated or painted is below 40°F (4.4°C); to wet or damp surfaces or in rain, snow, fog, or mist; when the temperature is less than 5°F (2.8°C) above the dew point; when it is expected the air temperature will drop below 40°F (4.4°C) or less than 5°F (2.8°C) above the dew point within 8 hours after application of coating or paint. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables.

If above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

C. Inspection

Concrete, non-ferrous metal, plastic and wood surfaces shall be visually inspected to insure proper and complete coverage has been attained. A destructive testing instrument, such as a Tooke Gage, shall be used if deemed necessary. Thickness of coatings and paint on ferrous metal surfaces shall be checked with a non-destructive, magnetic type dry film thickness gauge. Coating integrity of Systems A and C surfaces shall be tested with an approved inspection device. Holiday detectors shall not exceed the voltage specified by the manufacturer of the coating system. For film thicknesses between 10 and 20 mils (0.25 mm and 0.50 mm) a non-sudsing type wetting agent such as Kodak Photo-Flo, shall be added to the water prior to wetting the detector sponge. All pinholes shall be marked, repaired in accordance with the manufacturer's printed instructions and retested. No pinholes or other irregularities will be permitted in the final coating.

In cases of dispute concerning film thickness or "holidays", the Owner's calibrated instruments and measurements shall predominate. Wide film thickness discrepancies shall be measured and verified with a micrometer or other approved measuring instrument.

Contractor shall give the Owner a minimum of 3 working days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 working days advance notice of the start of any shop surface preparation work or coating application work.

D. Inspection Devices

The Contractor shall furnish, until final acceptance of coating and painting, inspection devices in good working condition for detection of holidays and measurement of dry-film thickness of coating and paint. The Contractor shall also furnish U.S. Department of

Commerce, National Bureau of Standards certified thickness calibration plates to test the accuracy of dry-film thickness gauge and certified instrumentation to test the accuracy of holiday detectors.

Dry-film thickness gauges shall be made available for the Owner's use at all times until final acceptance of application. Holiday detection devices shall be operated by the Contractor in the presence of the Owner. Acceptable devices for ferrous metal surfaces include, but are not limited to K-D "Bird-Dog" holiday detector for coatings to 20 mils (0.50 mm) dry film thickness, Tinker-Rasor Models AP and AP-W holiday detectors for coatings in excess of 20 mils (0.50 mm) dry-film thickness, and "Owner" units for dry-film thickness gauging. Non-ferrous metal surfaces shall be checked with an instrument such as an Elcometer "Eddy Current" Tester. Inspection devices shall be operated in accordance with the manufacturer's instructions.

E. Warranty Inspection

Warranty inspection shall be conducted during the eleventh month of the Contract warranty period. The Contractor and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Owner.

1.06 Safety and Health Requirements

A. General

Surface preparation and application of coatings shall be performed by the Contractor in compliance with all applicable federal, state, and local occupational safety, health, and air pollution control regulations. The Contractor shall obtain and comply with all safety precautions specified by the paint manufacturer in printed instructions or special bulletins. The Contractor shall provide and require use of personnel protective lifesaving equipment for persons working in or about the project site.

B. Head and Face Protection and Respiratory Devices

Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air-purifying, half-mask or mouthpiece respirator with appropriate filter.

C. Ventilation

Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminant to the degree a hazard does not exist.

D. Sound Levels

Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.

E. Illumination

Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Owner, the Contractor shall provide additional lighting and necessary supports to illuminate all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Owner.

F. Temporary Ladders and Scaffolding

All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Owner to facilitate inspection and be moved by the Contractor to locations requested by the Owner.

1.07 Extra Stock

Upon completion of all coating and painting work, Contractor shall deliver to the Owner a minimum of two 1 gallon cans of each type and color of finish paint and coating used on the project and two 1 gallon cans of each primer. Each container shall be unopened and properly labeled for identification and have a manufacture date within two months of the date of delivery to the Owner.

PART 2 - PRODUCTS

2.01 General

A. Products specified are those which have been evaluated for the specific service and are listed to establish a standard of quality. Requests for product substitution are subject to the requirements of the Contract Appendix, General Conditions, or Contractor Submittals Technical Specifications.

B. All materials shall be brought to job site in original sealed containers. Contractor shall provide coating material name, formula or specification number, batch number, color and date of manufacture to the Owner. Coating materials shall not be used until the Owner has inspected contents and checked information on containers or label. Materials exceeding storage life specified by the manufacturer shall be rejected.

C. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paints must be stored to conform with city, county, state, and federal safety codes for flammable coating or paint materials. Water based coatings or paints shall be protected from freezing.

D. Protective coatings shall be as manufactured by PPG Protective and Marine Coatings, Carboline Company, or Tnemec Company, or equal. Contractor shall use products of same manufacturer for all coating systems unless approved in writing by the Owner.

E. It is the intent of this specification that all coatings used meet local, state, and federal air pollution control regulations. These regulations change frequently. If a listed coating does not meet local, state, and federal air pollution control regulations at the time the work is actually performed, the Contractor shall provide the manufacturer's compliant,

recommended substitute coating at no additional cost to the Owner. All coatings shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1113.

2.02 Service Condition A

Ferrous metals subject to corrosive moisture or atmosphere and condensation such as outside of tanks, out-of-doors piping, valves, and equipment, bridges over process units, etc. shall receive the following surface preparation and coating:

A. Surface Preparation

Unless noted otherwise, all surfaces shall be field sandblasted in conformance with SSPC-SP10 (Near-White Blast Cleaning) to achieve a 2.0-3.0 mils (50-75 micron) angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum and maximum required times between coats shall be per the manufacturer's requirements. Written requests for shop surface preparation and application of the prime coat shall be reviewed and approved by Owner on a case-by-case basis. If approved by Owner, shop applied prime coat surface shall be field scarified by brush-blasting prior to application of intermediate coat.

C. Coating System

Unless otherwise noted, the prime coat shall have a minimum dry film thickness (MDFT) of 4.0 mils. The intermediate and finish coat(s) shall have a MDFT of 4.0 mils. The total dry film thickness of the complete system shall be a minimum of 12.0 mils.

Carboline System	Primer - Carboguard 890 VOC Intermediate - Carboguard 890 VOC Finish - Carbothane 134MC
PPG PMC System	Primer - Amerlock 2VOC or 400VOC Intermediate - Amerlock 2VOC or 400VOC Finish - Amershield VOC
Tnemec System	Primer - Hi-Build Epoxoline II Series L69 Intermediate - Epoxoline Series 22 Finish - Epoxoline Series 22

2.03 Service Condition B

Ferrous metals not subject to corrosive moisture or atmosphere and condensation; normal indoor or outdoor exposure such as metal doors, other architectural items; piping, valves, and pumps indoors, etc. shall receive the following surface preparation and coating:

A. Surface Preparation

Unless noted otherwise, all surfaces shall be field sandblasted in conformance with SSPC-SP6 (Commercial Blast Cleaning) to achieve a minimum 2.0 mils (50 micron) angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum and maximum times required between coats shall be per the manufacturer's requirements. Written requests for shop surface preparation and application of the prime coat shall be reviewed and approved by Owner on a case-by-case basis. If approved by Owner, shop applied prime coat surface shall be scarified by brush-blasting prior to application of finish coat.

C. Coating System

Unless otherwise noted, the prime coat shall have a MDFT of 4.0 mils. The finish coat (one or more) shall have a MDFT of 3.0 mils. The total dry film thickness of the complete system shall be a minimum of 7.0 mils.

Carboline System	Primer - Carboguard 890 VOC Finish - Carbothane 134MC
PPG PMC System	Primer - Amerlock 2VOC or 400VOC Finish - Amershield VOC
Tnemec System	Primer - Hi-Build Epoxoline II Series L69 Finish - Epoxoline Series 22

2.04 Service Condition C

Ferrous metals submerged or intermittently submerged in sewage or similar corrosive liquid, shall receive the following surface preparation and coating:

A. Surface Preparation

All surfaces shall be field sandblasted in conformance with SSPC-SP5 (White Metal Blast Cleaning) to achieve a 3.0 mils (75 micron) minimum angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. If recoating is required to correct pinholes, holidays or insufficient coating thickness; surfaces shall be scarified by brush-blasting prior to recoat.

C. Coating System

Unless otherwise noted, one coat shall be applied at a MDFT of 24.0 mils.

Carboline System	Finish - Plasite 4550 S
PPG PMC System	Finish - NovaGuard 840
Tnemec System	Finish - Perma-Glaze Series 435

2.05 Service Condition D

Buried ferrous metal surfaces shall receive the following surface preparation and coating:

A. Surface Preparation

All surfaces shall be cleaned in conformance with SSPC-SP10 (Near-White Blast Cleaning) to achieve a 3.0 mils (75 micron) minimum angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum time required between coats and prior to backfilling shall be per the manufacturer's requirements.

C. Coating System

Unless otherwise noted, one coat shall be applied to a total MDFT of 24.0 mils.

Carboline System	Finish - Plasite 4500 S
PPG PMC System	Finish - NovaGuard 840
Tnemec System	Finish - Epoxoline Series 22

2.06 Service Condition E

Ferrous metals subject to high temperature exposure (resistant to 1000°F, continuous) shall receive the following surface preparation and coating:

A. Surface Preparation

All surfaces shall be field sandblasted in conformance with SSPC-SP10 (Near-White Blast Cleaning) to achieve a 1.0 mil (25 micron) angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The maximum dry film thickness of this system shall not exceed the limits established by the manufacturer.

C. Coating System

Unless otherwise noted, the prime and finish coat dry film thickness (DFT) shall be in strict accordance with the manufacturer's requirements. Under no condition shall the maximum specified DFT be exceeded for the prime or finish coat.

Carboline System	Primer - Carbozinc 11 WB Finish - Thermaline 4700 VOC
Hi-Temp System	Primer - Hi-Temp 1050ZN Finish - Hi-Temp 1000V

2.07 Service Condition F

Non-ferrous or galvanized ferrous metals, specifically identified in the Contract Documents as requiring coating, shall receive the following surface preparation and coating:

A. Surface Preparation

All surfaces shall be cleaned in conformance with SSPC-SP3 and SP6 (Power Tool Cleaning and Commercial Blast Cleaning). Thoroughly roughen entire surface to be coated for a uniform angular surface profile of 1.0-3.0 mils (25-75 micron).

B. Application

Application shall be in strict accordance with manufacturer's printed instructions.

C. Coating System

Unless otherwise noted, one pre-treatment coat shall be applied with a MDFT of 2.0 mils. The pre-treatment coat shall be followed by primer and finish coats per the Service Condition specified in the Finish and Protective Coating Schedule.

Carboline System	Pre-Treatment Coat – Rustbond
PPG PMC System	Pre-Treatment Coat - Amerlock Sealer
Tnemec System	Pre-Treatment Coat - Uni-Bond DF Series V115

2.08 Service Condition G

Metals finished with asphalt, coal tar, or other bleeding type finish, specifically identified in the Contract Documents as not requiring removal prior to field coating, shall receive the following surface preparation and coating:

A. Surface Preparation

All surfaces shall be cleaned in conformance with SSPC-SP1 (Solvent Cleaning).

B. Application

Application shall be in strict accordance with manufacturer's printed instructions.

C. Coating System

Unless otherwise noted, one barrier coat shall be applied to a MDFT of 4.0 mils. The barrier coat shall be followed by primer and finish coats per the Service Condition specified in the Finish and Protective Coating Schedule.

Carboline System	Barrier Coat - Carboguard 890 VOC
PPG PMC System	Barrier Coat - Amerlock 2VOC or 400VOC
Tnemec System	Barrier Coat - Hi-Build Epoxoline II Series L69

2.09 Service Condition H

Concrete subject to continuous or intermittent submergence of potable water or treated waste water (secondary or tertiary effluent) where specified shall receive the following surface preparation and coating:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and free of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be abrasive blasted to provide a smooth, continuous surface. The remaining dressed surface shall be light shotblasted, ICRI-CSP3, to provide the necessary surface profile for proper adhesion to substrate. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263 (Standard Test Method for Indicating Moisture in Concrete by Plastic Sheet Method). In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application and curing shall be in strict accordance with manufacturer's printed instructions. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

Filler shall be applied to the entire surface and at the specified MDFT per the manufacturer's requirements. Unless otherwise noted, the finish coat shall be applied at a coverage rate not to exceed 100 square feet per gallon.

Tnemec System	Filler - MortarClad Series 218
	Primer - Epoxoline Series 22
	Finish - Epoxoline Series 22

2.10 Service Condition I

Concrete subject to continuous or intermittent submergence in raw sewage, scum, sludge or other corrosive liquid where specified shall receive the following surface preparation and coating:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and free of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be abrasive blasted to provide a smooth, continuous surface. The remaining dressed surface shall be light shotblasted, ICRI-CSP3, to provide the necessary surface profile for proper adhesion to substrate. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263. In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum and maximum required times between coats shall be per the manufacturer's requirements. If recoating is required to correct pinholes or insufficient system coating thickness, surfaces shall be brush-blasted prior to recoat. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

The surfacing filler shall be applied to the entire surface. Unless noted otherwise, finish coats shall be applied at a coverage rate not to exceed 40 square feet per gallon for the system.

Carboline System	Filler – Carboguard 510 Finish - Plasite 4550 S
PPG PMC System	Filler - Amercoat 114A Primer - Amerlock 2VOC or 400VOC Finish - Amercoat 351 (Use Amercoat 884 thickener for increase film build)
Tnemec System	Filler - MortarCrete Series 217 Resurfacer for Deteriorated Concrete - MortarClad Series 218 Finish - Perma-Glaze Series 435

2.11 Service Condition J

Concrete and masonry surfaces subject to corrosive spillage shall receive the following surface preparation and coating:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and free of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be abrasive blasted to provide a smooth, continuous surface. The remaining dressed surface shall be light shotblasted, ICRI-CSP3, to provide the necessary surface profile for proper adhesion to substrate. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263. In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum and maximum required times between coats shall be per the manufacturer's requirements. If recoating is required to correct pinholes of insufficient system coating thickness, surfaces shall be brush-blasted prior to recoat. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Non-Skid Finish

Where coating system is specified or shown on the Drawings for finished floor surfaces that include pedestrian traffic, the coating system shall include a non-skid finish. Non-skid finish shall consist of coarse sand, or other compatible material as specified by the manufacturer, and shall be broadcasted onto primer coat while still wet and follow with finish coat after required drying time.

D. Coating System

Filler shall be applied to the entire surface and at the specified MDFT per the manufacturer's requirements. Two finish coats are required. Unless otherwise noted, the finish coat shall be applied at a coverage rate not to exceed 70 square feet per gallon.

Carboline System	Filler – Carboguard 510 Primer – Semstone 140 Finish – Semstone 140
PPG PMC System	Filler - Amercoat 114A Primer - Amerlock 2VOC or 400VOC Finish - Amercoat 351
Tnemec System	Filler - MortarClad 218 Primer - ChemTread Series 239 Finish - Tneme-Glaze Series 282

2.12 Service Condition K

Interior and exterior concrete surfaces exposed to view, not subject to immersion and not subject to pedestrian traffic, and concrete block and masonry without integral color or architectural treatment, shall receive the following surface preparation and coating:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and free of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be abrasive blasted to provide a smooth, continuous surface. The remaining dressed surface shall be light shotblasted, ICRI-CSP3, to provide the necessary surface profile for proper adhesion to substrate. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263. In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. Minimum recoat times are dependent on topcoat and environmental conditions and shall be in strict accordance with the manufacturer's requirements. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

Unless noted otherwise, prime and finish coat coverage rates shall be per manufacturer's requirements. A maximum DFT of two coats shall be applied per manufacturer's requirements.

Carboline System	Primer - Flexxide Finish – Flexxide
PPG PMC System	Filler - Amercoat 114A Finish - Amerlock 2VOC or 400VOC
Tnemec System	Filler - Envirofill Series 130 Finish - Enduratone Series 1026

2.13 Service Condition L

Concrete floors subject to corrosive moisture and pedestrian traffic where specified shall receive the following surface preparation and coating:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and cleaned of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be blast cleaned in accordance with SSPC-SP7 (Brush-Off Blast Cleaning) to provide a smooth, continuous ICRI-CSP3 (Light Shotblast) minimum surface profile acceptable to coating manufacturer. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263. In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. Where a non-skid finish is specified broadcast #50 dry washed silica sand onto primer coat while still wet and follow with finish coat after required drying time. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

Filler shall be applied to the entire surface and at the specified MDFT per manufacturer's requirements. Unless noted otherwise, coating coverage rates and number of coats shall be per manufacturer's requirements.

Carboline System	Filler – Carboguard 510 Primer - Carboguard 890 VOC Finish - Carboguard 890 VOC
PPG PMC System	Filler - Amercoat 114A Primer - Amerlock 2VOC or 400VOC Finish - Amerlock 2VOC or 400VOC
Tnemec System	Filler - Envirofill Series 130 Primer - Epoxoprime Series 201 Finish - Tneme-Glaze Series 280

2.14 Service Condition M

Concrete, concrete block, and masonry furnished with an approved architectural finish (e.g. integral color or architectural treatment) shall receive the following surface preparation and clear sealing system:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces must be dry and shall be cleaned of all dirt, dust, grease, efflorescence, and other foreign matter before sealing.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

Unless noted otherwise, coating coverage rates and number of coats shall be per manufacturer's requirements.

Monopole System Monochem Aquaseal ME12 (use ME7 for dense substrates)

2.15 Service Condition N

Interior and exterior architectural woodwork and interior gypsum board shall receive the following surface preparation and coating:

A. Surface Preparation

1. Interior and Exterior Woodwork

Sand new or bare wood to remove any surface contamination and surface cells. For previously coated surfaces sand loose paint to a tight, adherent surface. Cracks, nail holes, and other defects shall be filled with putty or plastic wood before priming. All knots shall be sealed with an approved knot sealer. Prior to coating, all surfaces shall have a moisture content below level specified by coating manufacturer and be thoroughly cleaned and free of all foreign matter.

2. Interior Gypsum Board

Tape new gypsum board joints and top with a total of three applications of joint compound. Sand joints after each coat. Spray gypsum board with a light texture coat. Owner shall approve a test section prior to texture coating.

Prior to application of coating system, new gypsum board shall be coated with a sealer recommended by the coating manufacturer and approved by the Owner, or an additional prime coat of the specified system shall be applied.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions.

C. Coating System

Unless noted otherwise, two or more coats shall be applied at a coverage rate not to exceed 250 square feet per gallon for each coat.

Carboline System	Primer - Carbocrylic 3359 (semi-gloss) Finish - Carbocrylic 3359 (semi-gloss)
PPG PMC System	Primer - Seal Grip 17-921 Finish - Pitt-Tech Plus 90-1210 (semi-gloss)
Tnemec System	Primer - Enduratone Series 1029 (semi-gloss) Finish - Enduratone Series 1029 (semi-gloss)

2.16 Service Condition O

Exposed plastic and fiberglass surfaces, specifically identified in the Contract Documents as requiring coating, shall receive the following surface preparation and coating (coating to be used for this category shall be certified by the plastic and fiberglass manufacturer to be completely acceptable and non-injurious to the material):

A. Surface Preparation

Surface preparation shall consist of hand sanding to remove gloss. All remaining dust shall be removed with vacuum brushing or tack rag. Sanded surfaces shall not be washed with either solvent or water.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions.

C. Coating System

Unless noted otherwise, two or more coats shall be applied at a coverage rate not to exceed 375 square feet per gallon for the system.

Carboline System	Finish - Carbothane 134MC
PPG System	Finish - Amershield VOC
Tnemec System	Finish - Endura-Shield Series 1095

2.17 Service Condition P

Manufactured items furnished with shop-applied coat of primer requiring field touch-up or with a shop applied primer which is not compatible with the required coating system shall receive the following surface preparation and coating system:

A. Surface Preparation

All surfaces shall be cleaned in conformance with SSPC-SP2 (Hand Tool Cleaning), including hand sanding and feathering of damaged areas. If determined by the Owner that damage is too extensive for touch-up, item shall be recleaned and coated or painted as directed by Owner.

B. Coating System

Prime and finish coats shall be the system specified for the specific Service Condition. Prime coat shall be compatible with the required system. If not (as determined by the Owner) the prime coat shall either be removed by sandblasting or coated with a suitable primer which is compatible with the shop primer utilized and the coating system required. Costs incurred for repair or replacement of shop-applied primers shall be the sole responsibility of the Contractor.

2.18 Service Condition Q

Manufactured items furnished with shop-applied primer and finish coats requiring field touch-up shall receive the following surface preparation and coating system:

A. Surface Preparation

All surfaces shall be cleaned in conformance with SSPC-SP2 (Hand Tool Cleaning), including hand sanding and feathering of damaged areas. If determined by the Owner that damage is too extensive for touch-up, item shall be recleaned and coated or painted as directed by Owner.

B. Coating System

Prime and finish coats shall be the system specified for the specific Service Condition. Costs incurred for repair or replacement of shop-applied coatings or finishes shall be the sole responsibility of the Contractor.

2.19 Service Condition R

Ferrous metal tanks, vessels, or equipment containing raw water or potable water shall receive the following surface preparation and coating:

A. Surface Preparation

All interior surfaces, including miscellaneous accessories and components, submerged or unsubmerged, shall be field sandblasted in conformance with SSPC-SP10 (Near-White Blast Cleaning) to achieve a 2.0-4.0 mils (50-100 micron) angular surface profile.

All exterior surfaces, including miscellaneous accessories and components, shall be field sandblasted in conformance with SSPC-SP6 (Commercial Blast Cleaning) to achieve a 2.0 mils (50 microns) minimum angular surface profile.

B. Application

Application shall be in strict accordance with manufacturer's printed instructions. The minimum and maximum required times between coats shall be per the manufacturer's requirements. Written requests for shop surface preparation and application of the prime coat shall be reviewed and approved by Engineer on a case-by-case basis. If approved by Engineer, shop applied prime coat surface shall be field scarified by brush-blasting prior to application of finish coat.

C. Coating System

Interior Surfaces:

Interior coating system shall be certified by the National Sanitation Foundation to be in accordance with ANSI/NSF Standard 61 for potable water contact.

Unless otherwise noted, the prime and finish coats shall have a MDFT of 6.0 mils. The prime coat shall have two coats. The total MDFT of the complete system shall be 18.0 mils.

Carboline System	Primer - Carboguard 891 VOC Finish - Carboguard 891 VOC
PPG PMC System	Primer - Amercoat 133 Finish - Amercoat 133
Tnemec System	Primer - Series L140F Pota-Pox II Finish - Series L140F Pota-Pox II

Exterior Surfaces:

Unless otherwise noted, the prime coat shall be two coats or more with a MDFT of 4.0 mils (100 microns). The finish coat shall have a MDFT of 3.0 mils. The total MDFT of the complete system shall be 11.0 mils.

Carboline System	Primer - Carboguard 891 VOC Finish - Carbothane 134MC
PPG PMC System	Primer - Amerlock 2VOC or 400VOC Finish - Amershield VOC
Tnemec System	Primer - Series L140F Pota-Pox II Finish - Series 1095 Endura-Shield

2.20 Service Condition S

Concrete sealing and waterproofing shall receive the following surface preparation and coating system:

A. Surface Preparation

All concrete surfaces shall be aged for a minimum 28 days prior to application. All surfaces shall be prepared in accordance with SSPC-SP13 (Surface Preparation of Concrete) and free of all dirt, dust, form oil, curing compounds, efflorescence, and other deleterious compounds. All fins, form marks, protrusions, and rough edges shall be abrasive blasted to provide a smooth, continuous surface. The remaining dressed surface shall be light shotblasted, ICRI-CSP3, to provide the necessary surface profile for proper adhesion to substrate. All hollow areas, bug holes, honeycombs, large cracks, and voids shall be filled in accordance with Section 03300 and manufacturer's specified filler product. All surfaces shall be completely dry before application of the coating and tested for the presence of moisture per ASTM D 4263. In general, the concrete surfaces shall have a slight texture, be free of pockets and cavities, and be tightly adherent, not powdery.

B. Application

Application and curing shall be in strict accordance with manufacturer's printed instructions. Application shall not begin until substrate pH, moisture content, and temperature are within acceptable limits per manufacturer's printed instructions.

C. Coating System

Prior to coating, the concrete must be Saturated Surface Dry (SSD) and free of all standing water. All construction joints shall be coated by brush. Other surfaces shall be coated by brush or spray. Unless noted otherwise, finish coat shall be one coat for the system.

Vandex System	Filler - Vandex Premix Finish - Vandex Super
Xypex System	Filler - Xypex Concentrate Dry-Pac Finish - Xypex Concentrate

2.21 Miscellaneous Coatings

A. Aluminum Metal Isolation

1. Surface Preparation

Aluminum shall be thoroughly scarified first and cleaned per SSPC-SP1 (Solvent Cleaning).

2. Application

Application shall be in strict accordance with manufacturer's printed instructions.

3. Coating System

Unless otherwise noted, all aluminum bearing on, or embedded in, concrete shall be coated with two isolation coats with a total MDFT of 8.0 mils.

Carboline System	Barrier Coat - Carboguard 890 VOC
PPG PMC System	Barrier Coat - Amerlock 2VOC or 400VOC
Tnemec System	Barrier Coat - Hi-Build Epoxoline II Series L69

PART 3 - EXECUTION

3.01 General

A. All surface preparation, coating and painting shall conform to applicable standards of the National Association of Corrosion Engineers, the Society of Protective Coatings, the American Concrete Institute, the Forest Products Research Society, the International Concrete Repair Institute (ICRI), and the manufacturer's printed instructions. Material applied prior to approval of surface preparation by the Owner shall be removed and reapplied to the satisfaction of the Owner at the expense of the Contractor.

B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with the Owner.

C. Unless otherwise specified, dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.

D. Coating and painting systems include surface preparations, prime coatings and finish coatings. Surface preparation for a specific Service Condition shall be as specified for that coating or painting system. Unless otherwise specified, prime coatings shall be field applied. Where prime coatings are shop applied, they shall be thoroughly cleaned and touched up in the field as specified. If shop coatings are deficient or damaged too extensively for adequate repair, they shall be removed and coated and painted as directed by the Owner. Contractor shall instruct suppliers to provide prime coats compatible with the finish coats specified. Any off site work which does not conform to this specification is subject to rejection by the Owner.

E. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Contractor's equipment shall be subject to approval by the Owner.

3.02 Surface Preparation, Ferrous Metal

A. General

The latest revision of the following surface preparation specifications of the Society of Protective Coatings and the National Association of Corrosion Engineers shall form a part of this specification:

1. Solvent Cleaning (SSPC-SP1). Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.

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

3. Power Tool Cleaning (SSPC-SP3). Removal of loose rust, loose mill scale and other detrimental foreign matter to degree specified by power wire brushing, power impact tools or power sanders.

4. White Metal Blast Cleaning (SSPC-SP5). Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. Commercial Blast Cleaning (SSPC-SP6 and NACE No. 3). Blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.

6. Brush-Off Blast Cleaning (SSPC-SP7 and NACE No. 4). Blast cleaning to remove loose rust, loose mill scale and other detrimental foreign matter to degree specified.

7. Near White Blast Cleaning (SSPC-SP10 and NACE No. 2). Blast cleaning to nearly white metal cleanliness, until at least 95% of each element of surface area is free of all visible residues.

B. Slag and weld metal accumulation and spatters not removed by the fabricator, erector, or installer shall be removed by chipping and grinding. All rough welds shall be ground smooth and sharp edges shall be ground to approximately 1/8" radius.

C. Field blast cleaning for all surfaces shall be dry sandblasting unless otherwise directed.

D. The Contractor shall comply with all applicable local, state, and federal, air pollution control regulations for blast cleaning.

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

F. Maximum particle size of abrasives used in blast cleaning shall be that which will produce a surface profile in accordance with these specifications and the printed instructions of the manufacturer of the specified coating system to be applied.

G. Sand used in blast cleaning operations shall be washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused.

H. Shop applied temporary coatings or shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied.

I. During blast cleaning operations, caution shall be exercised to insure that existing coatings or paint are not exposed to abrasion from blast-cleaning.

J. The Contractor shall keep the area of his work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the prosecution of the work or the operation of the existing facilities.

K. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or another approved method prior to application of specified coatings or paint. No coatings or paint shall be applied over damp or moist surfaces.

L. All welds shall be neutralized with a suitable chemical compatible with the specified coating materials.

3.03 Surface Preparation, Coated and Uncoated Galvanized Steel, Stainless Steel, and Non-Ferrous Metals

Prior to application of specified pretreatment coating, coated and uncoated galvanized steel, stainless steel, and non-ferrous metals shall be brush-off blasted per SSPC-SP16 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

3.04 Surface Preparation, Ferrous Metal with Existing Coatings

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

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

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

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

3.05 Surface Preparation, Concrete and Masonry

A. Surface preparation shall not begin until at least 28 days after the concrete or masonry has been placed.

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

C. Concrete and masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned or equivalent in accordance with SSPC-SP13 to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface. The abrasive used should be dry and clean with the maximum particle size that will pass through a 16 mesh screen. Cracks and voids shall be repaired or filled with the specified filler and surfacer. Final surface shall be sound, firmly bonded, smooth and free of voids, cavities, dirt, dust, oils, grease, laitance, or other contaminants.

D. Residual abrasive, dust and loose particles shall be removed from the surface by vacuuming or blowing off with dry high pressure air.

E. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with an approved moisture detection device.

3.06 Surface Preparation, Wood and Composition Materials

All surfaces shall be cleaned of dirt, oil, or other foreign substances with mineral spirits, scrapers, sandpaper, or wire brushes. Finished surfaces exposed to view shall, if necessary, be made smooth by planing or sandpapering. Small, dry, seasoned knots shall be surface scraped, sandpapered, and thoroughly cleaned, and shall be given a thin coat of WP-578 Western Pine Association knot sealer before application of the priming coat. Large, open unseasoned knots, and all beads or streaks of pitch shall be scraped off, or if the pitch is still soft, it shall be removed with mineral spirits or turpentine and the resinous area shall be thinly coated with knot sealer. After priming, all holes and imperfections shall be filled with putty or plastic wood (colored to match the finish coat), allowed to dry, and sandpapered smooth. Existing surfaces shall be cleaned of all loose or flaking paint and sandpapered to a tight, adherent surface.

3.07 Coating and Painting Application, General

A. Coating and painting application shall conform to the requirements of the Society of Protective Coatings, Paint Application Specifications SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting", and recommended practices of the National Association of Corrosion Engineers, the American Concrete Institute, the Forest Products Research Society and the manufacturer of the coating and paint materials.

B. Application of the first coat shall follow immediately after surface preparation and cleaning and within an eight hour working day. Any cleaned areas not receiving first coat within an eight hour period shall be recleaned prior to application of first coat. Cleaned surfaces and all coats of the specified system shall be inspected prior to application of each succeeding coat. Contractor shall schedule such inspection with Owner in advance.

C. Prior to assembly, all surfaces made inaccessible after assembly, shall be prepared as specified herein and shall receive the coating or painting system specified.

D. Thinning shall be permitted only as recommended by the manufacturer and approved by the Owner.

E. Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application.

F. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, and variations in color, texture and finish, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

G. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces which are not to be coated or painted. Spray painting shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent facilities or adjoining property occurring from blast cleaning or coating operations.

H. When two or more coats of coating or paint are specified, each coat shall be of a slightly different shade to facilitate inspection of surface coverage of each coat.

I. Specified film thicknesses per coat for the Service Conditions are minimum required. Contractor shall apply additional coats as necessary to achieve the specified thickness.

J. All material shall be applied as specified.

K. All welds and irregular surfaces shall receive a brush coat of the specified product prior to application of the first complete coat.

L. Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

M. Drying time between coats and surface curing shall be as recommended by the coating manufacturer depending upon field conditions of temperature and humidity. Times shall be submitted with the shop drawings based on 70°F and relative humidity of 50%.

N. In the case of enclosed areas, the forced air ventilation system shall operate continuously to provide air circulation and exhausting of solvent vapors.

3.08 Shop Coating

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

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

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

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

E. Shop painted surfaces shall be protected during shipment and handling. Primed surfaces shall not be exposed to the weather for more than 6 months before topcoated, or less time if specified by the coating manufacturer.

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

G. The Contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of these specifications.

3.09 Protective Coating and Painting Schedule

The protective coating and painting schedule provided herein or on the drawings shall indicate the coating system to be used. The schedule shall not be construed as a complete list of all surfaces to be coated but rather as a guide as to the application of the various coating systems. All surfaces shall be coated and painted except those specifically excluded herein or on the drawings.

3.10 Color Scheme

All colors and shades of colors of all coats of paint and protective coating material shall be as selected by the Owner, except as noted below under "Pipe Color Coating". The Contractor shall submit a current chart of the manufacturer's available colors to the Owner at least forty-five days prior to the start of coating and painting operations.

3.11 Pipe Color Coding and Labeling

All exposed piping shall be color coded and labeled to conform to all OSHA requirements and "Scheme for the Identification of Piping Systems" (ANSI A13.1). "State (10) Standards" color scheme shall be used to further identify specific commodity. As a guideline the following color coding schedule is provided. Color codes shall be confirmed with Owner prior to commencing work.

A. Color Code Schedule

Item	Color Code
Aeration Air	Safety Green
Aftercooler Return	Safety Red
Aftercooler Supply	Safety Red
Air Scour	Safety Green
Alum	Safety Yellow/Red Bands
AWT Bypass	Safety Red
Belt Press Return Water	Gray
Caustic Soda	Safety Orange
Chemical Drain	Safety Orange
Chlorine Gas	Safety Yellow
Chlorine Liquid	Safety Yellow
Chlorine Solution	Safety Yellow
Chlorine Vacuum	Safety Yellow
Cold Sludge	Brown
Digested Sludge	Brown
Digested Sludge Exchange	Brown
Drain	Gray
Engine Cooling Water	Safety Red
Engine Exhaust	Safety Red
Filter Backwash	Safety Red
Filter Backwash Return	Safety Red
Filter Effluent	Safety Red
Filter Influent	Safety Red
Fire Water	Safety Red
Flotation Thickener Overflow	Brown
Flotation Thickener Return	Gray
Foul Air	White
Froth Spray	Safety Red
Fuel Oil	Black
Fuel Oil Return	Black
Fuel Oil Supply	Black
Gravity Thickener Overflow	Brown
Ground Water Drainage	Gray
Grit	Brown
Grit Chamber Influent	Brown
Grit Washer Overflow	Gray
Heat Recovery Return	Safety Blue/Orange Bands
Heat Recovery Supply	Safety Blue/Orange Bands
Heated Sludge	Brown/Yellow Bands
Holding Tank Overflow	Brown

Item	Color Code
High Pressure Digester Gas	Light Yellow
High Temperature Wash Water	Safety Blue/Orange Bands
Hydrogen Peroxide	Safety Orange
Industrial Water	Safety Red
Influent Force Main	Brown
Jacket Water Return	Safety Red
Jacket Water Supply	Safety Red
Liquid Propane Gas	Light Yellow
Low Pressure Digester Gas	Light Yellow
Lube Oil Return	Black
Lube Oil Supply	Black
Lube Oil Waste	Black
Methanol	Safety Yellow/Red Bands
Natural Gas	Light Yellow
Plant Air	Safety Green/Yellow Band
Plant Effluent	Safety Red
Polymer	Safety Yellow/Blue Bands
Potable Water	Safety Blue
Primary Influent	Brown
Primary Skimmings	Brown
Primary Sludge	Brown
Pumped Drainage Water	Gray
Raw Influent	Brown
Return Activated Sludge	Brown
Return Water	Safety Red
Sample	Safety Red
Sanitary Drain	Gray
Seal Water	Safety Red
Secondary Effluent	Safety Red
Secondary Skimmings	Brown
Secondary Sludge	Brown
Skimmings	Brown
Sludge Heater Bypass	Brown
Sludge Return	Brown
Sludge Transfer	Brown
Spray Wash	Safety Red
Storm Drain	Gray
Sulfer Dioxide Gas	Safety Orange
Sulfer Dioxide Liquid	Safety Orange
Sulfer Dioxide Solution	Safety Orange
Sulfer Dioxide Vacuum	Safety Orange

Item	Color Code
Tank Drain	Brown
Tertiary Effluent	Safety Red
Thickened Digested Sludge	Brown
Thickened Sludge	Brown
Thickened Waste Activated Sludge	Brown
Thickener Dilution Water	Safety Red
Vent	White
Ventilation Air	White
Wash Water	Safety Red
Waste Activated Sludge	Brown
Waste Sludge	Brown

B. Label Coding

Pipe labels (or markers) shall be pressure-sensitive, self-adhesive, vinyl film pipe markers as manufactured by Seton Name Plate Corporation, or equal. Background colors, letter colors, letter heights and spacing shall conform with ANSI A13.1. Pipe designation labels and direction-of-flow arrows shall be placed at 10 foot intervals (maximum) and at every change in direction. Pipe designation wordings shall be selected by the Owner and may not correspond to standard wordings available from the manufacturer.

3.12 Cleanup

Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved the Owner. Coating or paint spots and oil or stains upon adjacent surfaces shall be removed and the job site cleaned. All damage to surfaces resulting from the work of these specifications shall be cleaned, repaired or refinished to the satisfaction of the Owner and at no additional cost to the Owner.

END OF SECTION

SECTION 11005
GENERAL MECHANICAL AND EQUIPMENT REQUIREMENTS

PART 1 - GENERAL

1.01 Description

A. These General Mechanical and Equipment Requirements, which apply to all systems and equipment unless specified otherwise in the equipment Technical Specifications or on the Drawings, are hereby made a part of each and all of the separate Sections of this Specification. Contractor shall direct the attention of all subcontractors and suppliers of mechanical and related appurtenances to the provisions of the Contract Documents and this Section.

B. The Contractor shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant work, complete and operable, all in accordance with the requirements of the Contract Documents.

1.02 Submittals

A. Shop Drawings

The Contractor shall furnish complete shop drawings for all equipment specified in the various Sections of the specifications and the Construction Drawings, together with all piping, valves, and controls for review by the Owner in accordance with Specification Section 01300, Contractor Submittals and Requests Technical Specifications.

B. Lateral Design Data

Submit with the shop drawings, details of constructions, and method of attachment for all manufactured products showing compliance with Part 3.04, "Lateral Design and Restraint". Where specified in the Special Requirements, Special Construction Provisions, or Technical Specifications for certain equipment, calculations and details signed by a Professional Engineer who has demonstrated proficiency in Structural Engineering or Civil Engineering and is registered in the State of California shall be submitted. The calculations shall be performed specifically for this project, during the time frame of the project and be dated by the Engineer performing them.

C. Tools

The Contractor shall supply one complete set of special wrenches or other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright, finished heads and with work faces dressed to fit nuts. The set of tools shall be neatly mounted in a labeled tool box of suitable design provided with a hinged cover.

D. Operation and Maintenance Manuals

Prepare and submit manuals covering all mechanical equipment and machinery and its electrical components in accordance with General Provisions and Technical Specifications for equipment.

E. Manufacturer's Certified Reports

Each equipment manufacturer, or his authorized representative, shall submit a written report stating that equipment is ready for start-up and interim operation, and a subsequent written report certifying that the equipment has been properly installed, lubricated, aligned, started-up, tested, adjusted, and operated over the equipment range (full to minimum load, speed, range); the equipment is free from any undue stress imposed by connecting piping or anchor bolts, and is ready for operation by the Owner; equipment is safe to operate and that the equipment is fully covered under the terms of the guarantee. Note that interim operation of equipment may be necessary to provide required treatment or suitable plant operation.

F. Contractor's Certification Reports

Contractor shall submit a written certification along with the manufacturer's certification for start-up and interim operation that he has examined subject equipment and confirms that it is ready for start-up and interim operation and is safe to operate.

Contractor shall submit written certification for relocated, modified, temporarily installed Owner's equipment or Contractor furnished equipment that has been installed for interim operation by the Owner stating that said equipment has been started-up, is ready for operation and is safe to operate.

G. Lifting Recommendations

Each manufacturer shall provide details for proper lifting of equipment and materials during unloading, handling, and installation. Means of lifting equipment shall not impose any undue stress to the equipment. Contractor shall strictly adhere to said manufacturers recommendations.

H. Storage Requirements

Each manufacturer shall provide details and storage of equipment and materials for protection under the specific conditions of the project site, such as rain, snow, freezing, windy, wind blown sand, high temperatures, direct sunlight, etc.

1.03 Quality

A. Factory Inspection

The Owner or its representative may inspect fabricated equipment at the factory without cost to Contractor. The Contractor shall notify the Owner in sufficient time so that factory inspection can be arranged. Factory inspection will be made after manufacturer has performed satisfactory checks, adjustments, tests and operations. Approval of

equipment at the factory only allows the manufacturer to ship the equipment to the site, and does not constitute final acceptance by the Owner.

B. Standard of Quality

Items of equipment are specified by performance and by name of a manufacturer for the purpose of establishing a standard of quality and acceptable experience. Where "or equal" or "approved equal" is specified Substitute equipment will be acceptable if it can be demonstrated to the Owner that the substitute is in strict accordance with the Specifications and equal in quality to those models specifically named. Substitutions shall be submitted in accordance with Contractor Submittals Technical Specifications. Manufacturers specified have been determined by the Owner to meet or exceed the minimum acceptable standard for the designated equipment; however, manufacturer's standard model may require optional equipment, upgrade or modification to meet the intent and requirements of the specifications. All mechanical equipment furnished under this Specification shall be new and of current design.

C. Manufacturer's Experience

Unless specifically named in the detailed Specifications, a manufacturer shall have furnished equipment of the type and size specified which has demonstrated successful operation and is in regular use.

D. Field Inspection, Start-up, and Adjustment

The Contractor shall demonstrate that all equipment meets the specified performance requirements. Contractor shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment who shall visit the site of Work to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. To inspect, check, adjust if necessary and approve the equipment installation.

3. To start-up and field-test the equipment for proper operation, efficiency, and capacity and to assure that equipment is ready and safe to operate.

4. To perform necessary field adjustment during the test period until the equipment installation and operation are satisfactory to the Owner.

5. To instruct the Owner's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

E. Costs

The costs of all inspection, start-up, testing, adjustment, and instruction work performed by said factory-trained representatives shall be borne by the Contractor. When available, the Owner's operating personnel will provide assistance in the field testing.

1.04 Equipment

A. General

All equipment furnished shall be complete, ready for installation and operation. All bolts, nuts, washers, mounting plates, bed plates, bases, anchor bolts and other miscellaneous items necessary to form a complete, installed, operational system shall be furnished whether specifically specified or not.

B. Conditions of Service

All equipment shall be capable of operating over the full range specified under the project site environmental conditions including altitude, temperature, relative humidity, freezing, or windy condition as shown on the Drawings or specified in the Special Requirements.

C. Adaptation of Equipment

No responsibility for alteration of a planned structure to accommodate substitute equipment will be assumed by the Owner. Equipment which requires alteration of the structures will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All revisions to structures, mechanical, electrical, or other work made necessary by such substitution shall be approved by the Owner and the cost of said revisions, including cost of redesign, shall be made at the Contractor's expense.

D. Motors

Ratings specified and/or shown for the proposed equipment are in accordance with the best information available to the Owner. In the event any equipment item proposed by the Contractor should require motors with larger horsepower rating than indicated on Electrical Drawings, it shall be the Contractor's responsibility to provide the proper control equipment, required modifications to motor control centers, starting equipment, feeder and branch circuits, and accessories as required to make the installation comply with the electrical code and to prevent excessive voltage drop without added cost to the Owner.

E. Match Equipment and Driver

Equipment shall be matched such that the motor rating meets or exceeds the driven equipment requirements (over its full operating range) and the motor controller, switchgear, variable speed drive, etc. meets or exceeds the motor requirements. Where the motor controller or variable speed drive will induce additional heat or otherwise cause derating of the motor, the motor shall be oversized accordingly.

F. Existing Equipment

Where equipment to be furnished is installed in an existing enclosure or adjacent to existing equipment, the Contractor shall field check the dimensions of existing

equipment, location of conduits, etc., and shall familiarize himself with all existing conditions and difficulties to be encountered in performing such work.

1.05 Guarantee and Warranties

The Contractor shall guarantee all equipment in accordance with the conditions of the Contract Documents and as specified in the Contract Appendix, General Provisions, or Special Requirements. In addition to the general guarantee requirements, equipment guarantee shall cover faulty or inadequate design; improper assembly or erection; defective workmanship or materials; and leakage, breakage, or other failure. For equipment specified in the Technical Specifications to be provided with a manufacturer's warranty in excess of one (1) year, furnish a copy of the warranty to Owner with Owner named as beneficiary.

PART 2 - PRODUCTS

2.01 General Requirements

A. Materials and Workmanship

All equipment furnished shall be new and guaranteed free from defects in materials, design, and workmanship. It shall be the manufacturer's responsibility to ascertain the conditions and service under which the equipment will operate and to warrant that operation under those conditions shall be successful. All parts of the equipment shall be amply proportioned for all stresses that may occur during fabrication, erection, and intermittent or continuous operation.

B. Standards

All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests. Materials shall be suitable for service conditions. Iron castings shall be tough, close-grained gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A48. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall have a minimum nominal thickness of 1/4-inch. Provide equipment and materials suitable for the service conditions and meeting standard specifications such as ANSI, ASME, AWWA, ASTM, NEMA, CBC and UL. The location of the fabricator and his shop schedule shall be furnished to the Owner prior to the beginning of fabrication so that the Owner can schedule shop inspection.

C. Structural Steel Fabrications

Conform to "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the AISC unless otherwise indicated or specified. Design all fabrications for dynamic and vibratory loadings. Use structural steel shapes conforming to ASTM A36, A440, A500, A501, A570, A618, or equal, as applicable. Galvanize specified items in accordance with ASTM A123, A153, or A386 as applicable; use galvanized bolts and fasteners with galvanized assemblies.

D. Welding

Unless otherwise specified or shown, all welding shall conform to the following:

1. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Except as modified herein, welding process qualification and operator qualification shall comply with the applicable requirements of the "Code for Arc and Gas Welding in Building Construction" of the AWS.

2. Latest revision of ANSI/AWWA D100 and AWWA C206.

3. Each weld shall be uniform in width and size throughout its entire length. Each layer shall be smooth, free from slag, cracks, pinholes, and undercut and shall be completely fused to adjacent weld beads and base metal. Cover pass shall be completely free of coarse ripples, irregular surfaces, non-uniform bead pattern, high crown, deep ridges or valleys between beads, and shall blend smoothly and gradually into surface of base metal. Butt welds shall be slightly convex, of uniform height, and shall have full penetration. Fillet welds shall be of size indicated, with full throat, and with each leg of equal length. Repair, chipping, or grinding of welds shall not gouge, groove, or reduce base metal thickness.

4. All composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. Protective Coatings

All equipment shall be painted or coated in accordance with Basic Coating and Painting Specifications for Water and Wastewater Facilities.

F. Protection of Equipment

All equipment including valves shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, or electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings.

G. Electrical Equipment

Maintain electrical equipment, controls, and keep insulation dry at all times. Keep heaters in equipment connected and operating until equipment is placed in operation.

2.02 Lubrication

A. Lubrication Systems

Lubrication of equipment shall ensure constant presence of lubricant on all wearing surfaces. Lubricant fill and drain openings shall be readily accessible. Easy means for checking the lubricant level shall be provided. Prior to testing and/or operation, the equipment shall receive the prescribed amount and type of lubricant as required by the equipment manufacturer. Equipment lubrication systems shall be systems that require attention no more often than weekly during continuous operation, shall not require attention during start-up or shut down, and shall not waste lubricants.

B. Lubrication

Contractor shall have all moving parts of the furnished equipment lubricated prior to shipment to insure protection against corrosion during shipment, storage, and installation. Lubricants furnished by Contractor shall conform to the manufacturer's printed recommendations. Safeguard(s) shall be provided where necessary to prevent operation of the equipment without proper lubrication.

Contractor shall provide Alemite lubrication fittings at all locations on the equipment which require grease lubrication. All lubrication fittings shall be readily accessible. The grease passages and ports shall be designed so that grease is forced into the normally loaded sides of the bearings.

Contractor shall lubricate all equipment prior to start-up.

Contractor shall furnish grease lubricants for testing and initial lubrication, and for protection of wearing surfaces of equipment he furnishes during shipment and storage. Where lubricants can come in contact with potable water, the lubricant shall not have

any toxic or deleterious effect on potable water and shall be of material approved by the FDA in accordance with Federal Regulation No. 121.253, Category AA.

Contractor shall furnish one year's supply of lubrication oils, grease, and other necessary lubricants including applicators and grease guns required for lubrication. All lubricants shall be as specified by the equipment manufacturer. Contractor shall limit the various types of materials by consolidating, with the equipment manufacturer's approval, the required lubricants into the least number of different lubricants. Contractor shall coordinate with Owner to match, where possible, lubricants normally used by Owner.

2.03 Equipment Supports

A. Equipment Bases and Bedplates

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate unless otherwise shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting. All mechanical equipment, tanks, control cabinets, motor control centers, etc. shall be mounted on raised concrete bases, unless otherwise shown or specified. Provide plates of minimum thickness of 1/4-inch. Pump bedplates shall include a drip lip and associated piping and appurtenances for directing gland leakage to a single disposal point.

B. Anchors and Sleeves

Each equipment manufacturer shall be responsible to design and specify the required anchor equipment including bolts, nuts, washers, and sleeves for securing equipment bases and bedplates to concrete bases. Loads shall be those induced by the equipment and lateral loads as specified herein. Design calculations are specifically required for certain equipment by the Special Requirements or Technical Specifications. Where specified or where specialty anchoring equipment is necessary for the equipment being furnished the anchoring equipment shall be furnished by the manufacturer. Sleeves shall be at least 1-1/2 times anchor bolt diameter. Anchor bolts shall be as specified on Drawings or, if not specified, shall be Type 316 stainless steel and of adequate length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified.

2.04 Couplings

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate angular misalignment, parallel misalignment, end float, and to cushion shock loads.

B. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taperlock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.05 Shafting

A. General

All shafting shall be continuous between bearings and shall be sized to transmit the maximum power output of the driver. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. All shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. Materials

Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as shown or specified unless furnished as part of an equipment assembly.

2.06 Bearings

A. General

Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA). Bearings shall be as specified by the specific equipment specification and as generally specified herein.

Bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other important factors shall be considered in bearing selection.

All re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection and disassembly.

Sleeve-type bearings shall have a Babbit or bronze liner.

B. Bearing Life

Except where otherwise specified or shown, all bearings shall have an L-10 minimum rated life expectancy corresponding to the type of service, as follows:

	Type of Service	Design Life (years) (whichever comes first)	L-10 Design Life (hours) (whichever comes first)
1.	16-Hour Shift	10	40,000
2.	Continuous	10	60,000

2.07 Gears and Gear Drives

A. Unless otherwise specified, gears shall be machine cut, of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum L-10 bearing life of 60,000 hours and a minimum efficiency of 94 percent. Worm gears shall not be used, unless specifically approved by the Owner.

B. All gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, self-cooling, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided, arranged for easy reading.

Where the Contractor elects to furnish equipment requiring external cooling by water or radiator he shall be responsible to furnish and install the cooling facilities necessary for proper operation.

C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

D. Material selections shall be left to the discretion of the manufacturer, provided the above AGMA values are met. Input and output shafts shall be adequately designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have 2 positive seals to prevent oil leakage.

E. Oil level and drain location relative to the mounting arrangement shall be easily accessible. Oil coolers or heat exchangers with all required appurtenances shall be furnished when necessary.

F. Where gear drive input or output shafts have to connect to couplings or sprockets supplied by others, the Contractor shall have the gear drive manufacturer supply matching key taped to the shaft for shipment.

2.08 Safety Guards

All equipment furnished by Contractor shall comply with the applicable requirements of the Safety Orders of the Division of Industrial Safety of the State of California. Copies of the Safety

Orders as available at the Printing Division, Documents Section, State of California, Sacramento, California, 95814.

Cover belt or chain drives, fan blades, couplings, exposed shafts, other moving or rotating parts and hot surfaces (exhaust pipes) on all sides with safety guards. Safety guards shall be free of all sharp edges and corners. Use corrosion-resistant materials at least equivalent to hot-dip galvanized steel. Safety guards shall be fabricated from 16 USS gage, or heavier, galvanized or aluminum-clad steel or 1/2-inch mesh galvanized expanded metal. Design guards for easy installation and removal. Provide necessary supports, accessories, and fasteners, of hot-dip galvanized steel or stainless steel. Design guards in outdoor locations to prevent entrance of rain and dripping water.

2.09 Manufacturer's Nameplates

Manufacturer shall provide Type 316 stainless steel nameplates of ample size with embossed or preprinted lettering, fastened to the equipment in a prominent place with 316 S.S. pins. On nameplates, display manufacturer, serial number, date of manufacture, model number and essential operating characteristics. Inscribe data plates with specific or directed information.

2.10 Equipment Identification Nameplates

In addition to manufacturer's nameplates specified in equipment Technical Specifications and herein, Contractor shall provide project specific equipment identification nameplates. Equipment mounted out-of-doors shall be furnished with nameplates constructed of Type 316 stainless steel with 3/8" high embossed lettering and shall be fastened to the equipment in a prominent place with 316 stainless steel pins.

Equipment mounted indoors shall be furnished with nameplates constructed of laminated engraving plastic. Nameplates shall be fastened to the equipment in a prominent place with 316 stainless steel pins. Colors, lettering, styles, and sizes shall be as selected by Owner.

Nameplates shall display the project specific identification of each equipment item. Proposed nameplate wording shall be submitted to Owner for approval.

PART 3 - EXECUTION

3.01 Coordination

Contractor shall coordinate the installation of equipment and assure compliance with Drawings. Said Drawings show in a diagrammatic form the arrangements desired for the principle apparatus, piping, and similar appurtenances, and shall be followed as closely as possible. Contractor shall take all measurements for his Work at the installation sites, verify all subcontractor and equipment drawings and be responsible for the proper installation. Specific equipment furnished may require certain modifications for installation. Contractor shall have all pertinent equipment shop drawings submitted and accepted by Owner prior to performing work impacted by said equipment.

Contractor shall coordinate, monitor, schedule the fabrication, and verify compliance with Contract Documents of equipment assembled of several components under the unit responsibility

of one manufacturer or equipment supplier. Contractor shall submit the following information to the Owner in writing on a monthly basis:

A. Shipment dates of the various components to the unit responsibility manufacturers.

B. Scheduled dates of factory tests by unit responsibility manufacturers.

C. Schedule shipment dates to site of unit responsibility items.

D. Scheduled arrival date, installation date and start-up date.

3.02 Installation

A. Inspection

Contractor shall inspect each item of equipment for damage, defects, completeness, and correct operation before installing and inspect previously installed related Work to verify that it is ready for installation of equipment. Contractor shall inspect the completed installation.

B. Preparation

Prior to installing equipment, Contractor shall ensure that installation areas are clean and that concrete or masonry operations are completed. Contractor shall maintain the areas in a broom-clean condition during installation operations. Equipment shall be cleaned, conditioned, and serviced in accordance with Instruction Manuals and the Contract Documents before installing.

C. Certification

Upon completion of equipment installation certifications from the manufacturer and the Contractor in accordance with Part 1.02 shall be submitted.

D. Equipment Installation

Contractor shall employ skilled craftsmen experienced in installation of the types of equipment specified and use specialized tools and equipment, such as precision machinist levels, dial indicators, gages, and micrometers, as applicable.

E. Anchor Bolts

Equipment shall be attached to concrete base using cast in place anchor bolts. Contractor shall set anchor bolts correctly before structural concrete is placed. Use of templates or setting drawings is required. An acceptable anchorage system is a cast in place sleeve anchor which allows adjustment as manufactured by DECO Manufacturing Co. or equal. Deferred bolting devices shall not be permitted, unless otherwise shown on Drawings.

F. Base and Bedplate Grouting

Prior to placing grout, initial fitting and alignment of connected piping shall be completed. Once equipment is leveled and aligned to the manufacturer's tolerances, base or bedplates can be grouted by filling the entire space between the base or bedplate and concrete foundation. Exposed grout, shall be troweled to a smooth dense finish, edges beveled to 45 degrees and damp cured with burlap for three days. When grout is fully hardened, Contractor shall remove jacking screws and tighten nuts on anchor bolts. Equipment alignment and level shall be checked for conformance with manufacturer's tolerances and corrective work performed as necessary.

3.03 Equipment Shop and Field Performance Testing

A. General

Equipment shall be shop tested and field tested as specified in the specific Technical Specifications.

B. Field Testing

Unless otherwise specified field testing of equipment shall be performed to demonstrate compliance with Contract Documents. Equipment operation, over the entire specified range, shall be free of vibration, noise, or cavitation. Contractor shall furnish test instruments required to confirm performance. Testing shall include the following:

1. Vibration shall be checked and recorded over the operating range and shall be equal to or less than the amplitude limits recommended by the manufacturer or as otherwise specified. As a minimum, pumping units shall meet or exceed the vibration requirements of the Hydraulic Institute Standards.

2. Equipment performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, and equipment output. Readings shall be documented for at least three operating conditions. Each power lead to the motor shall be checked for proper current balance.

3. In the event any equipment fails to meet the performance requirements, it shall be modified and retested.

3.04 Lateral Design and Restraint

All manufactured equipment supplied under this Contract shall be designed, constructed and attached to resist stresses produced by seismic forces and wind forces as specified. Equipment that does not vibrate during normal operation shall be rigidly attached. Equipment that vibrates during normal operation shall be attached by means of isolators with mechanical stops that limit movement in all directions unless it can be demonstrated by calculations that such stops are not required. Equipment or portions of equipment that move during normal operation shall be restrained with mechanical devices that prevent displacement unless it can be demonstrated by calculations that such restraints are not required.

A. Calculations shall be submitted where required by the Special Provision, Special Requirements or Technical Specifications.

B. Minimum Lateral Forces

The minimum lateral seismic and wind forces shall be those prescribed for Occupancy/Risk Category IV Facilities by the California Building Code and applicable supplements as published by the California Buildings Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833. Higher lateral forces shall be utilized where specified.

C. Contractor shall make submittals of shop drawings, details and data requested herein in accordance with the Contract Appendix or General Provisions and applicable Technical Specifications.

END OF SECTION

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SECTION 11320
DEEP WELL VERTICAL TURBINE PUMPING UNIT
TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 Specific Project Description

See Section 11325 of the Technical Specifications for specific project description.

1.02 Specific Project Pumping Unit Requirements

See Section 11325 of the Technical Specifications for specific project pumping unit requirements.

1.03 Pumping Unit Data to be Submitted by Bidder

Unless specified otherwise in Section 11325, Part 1.02 of the Technical Specifications, bidder shall submit (with his bid) a certified pumping unit component drawing for each different pumping unit to be furnished and it shall show dimensions of pumping unit and its components including bowl assembly, column assembly, tube and shaft assembly, discharge head assembly, motor, and related appurtenances.

Bidders shall submit (with his bid) a certified manufacturer's pump performance curve together with design calculations for each different pump to be furnished. Each curve shall show shut-off head, head versus capacity, pump bowl efficiency versus capacity, brake horsepower versus capacity, overall (wire to water) efficiency versus capacity, all for full operating range specified.

Each certified manufacturer's pump curve shall be continuous from zero capacity to maximum pumping unit capacity on the abscissa. It shall be furnished full size on 8-1/2 inches (ordinate) x 11 inches (abscissa) paper. Bidder shall indicate certified values on each curve for the following characteristics at all specified design points since consideration will be given thereto in selecting units to be furnished.

A. Discharge capacity in gallon per minute.

B. Total discharge head in feet (bowl head).

C. Pump bowl efficiency.

D. Brake horsepower (including losses in pump, shaft, column, and head).

E. Wire to water efficiency (including losses in motor, pump, shaft, column, and head).

F. Down thrust and momentary up thrust.

G. Calculations for design of thrust bearings and line shafting.

Bidder shall submit (with his bid) a guaranteed motor performance curve together with other performance data for each different motor to be furnished. Each curve shall denote horsepower, service factor, efficiency, locked rotor current, and temperature rise and each curve shall show

efficiency, power factor, speed, kilowatt input, current, and line voltage under operating range between full load and half load.

1.04 Contractor Submittals

Complete submittals (shop drawings) showing performances, fabrication, assembly, and installation, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, wiring diagrams, and other accessories forming a part of the pumping units shall be submitted in accordance with Specification Section 01300. Submittals shall include, but shall not be limited to, the following:

A. Submit the following minimum information for each pumping unit specified herein for the Owner's review and approval:

1. Items as specified in Part 1.03

2. Type and model number with reference to pumping units suitability for service for pumps specific intended use.

3. Assembly drawing, nomenclature and material list.

4. Type, manufacturer, model numbers, location and spacing of bearings.

5. Impeller diameter, eye area, sphere size, and identification number.

6. Maximum rotative speed.

7. Complete performance curves indicating total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head required, RPM, and efficiency.

   The manufacturer shall indicate by arrows to points on the H/Q curves the limits recommended for stable operation, between which pumps are to be operated to prevent surging, cavitation, and vibration. The stable operating range shall be as large as possible and shall be based on actual hydraulic and mechanical characteristics of the units.

   Provide performance curves for 100%, 90%, 80%, 75%, 50%, and 33% speed showing limits of recommended operation for pumping units specified for operation with variable frequency drives.

   Provide certified factory test pump performance curves prior to shipment.

8. Suitability for pressure ranges specified.

9. Motor data, including the manufacturer, size, type designation, minimum guaranteed efficiency and power factor at full load, 3/4 load, and 1/2 load, locked motor current in amps, full load current in amps, the motor speed in rpm, mounting details, and other data as required in the Contract Documents.

10. Written certification of motor inverter duty rating for pumping units specified for operation with variable frequency drives.

11. Outline dimensions and weights of pumping unit components and as assembled.

12. Materials of pump construction including bowls, bowl lining, shafts bearings, impellers and castings. Written certification of pumping units capability to withstand specified pressures.

13. Protective coating of pumping unit.

14. Installation instructions.

15. Operation and maintenance manuals.

1.05 Quality

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications. Manufacturer shall demonstrate to the satisfaction of the Owner that pumps of similar construction are in service and functioning properly. Manufacturers as specified herein manufacture pumping units with acceptable quality or experience. Manufacturers must, however, meet the performance requirements stated herein for the actual pumps specified. Listing of said manufacturers does not imply that said performance requirements can be met for each pumping unit specified. Contractor shall be responsible to verify that manufacturers supplying equipment meet the size and capacity requirement specified herein.

B. Pump manufacturer shall verify applicability of pumping equipment with respect to NPSHA, suction piping, can and discharge geometry to assure prevention of cavitation, vibration, surging, overheating, corrosion, and vortexing.

C. Pumping unit Supplier shall be an authorized distributor approved by Owner. Said distributor shall have adequate service facilities within a 60 mile radius of Owner's office and shall have a service organization, machine shop facilities, and parts inventory such that servicing or replacement of pumping units can be provided with minimum delay.

PART 2 - PRODUCTS

2.01 General

Deep well vertical turbine pumps shall be enclosed line shaft (oil lubricated) or open line shaft (water lubricated) type, whichever is specified, with aboveground flanged discharge and enclosed impellers.

All parts of the pump exposed to water shall be of stainless steel, brass, heavy cast iron, or equivalent corrosion resistant material.

Unless otherwise specified herein, all applicable Specifications of AWWA E 101 (Part A), latest, are hereby made a part of these Specifications.

Pumps shall be manufactured by Goulds, Flowserve, Peerless, Fairbank-Nijhuis or approved equal.

2.02 Pump and Components

A. Pump Bowls

Bowls shall be of close-grained, gray cast iron, Class 30 or better, precision cast, free from blow holes, sand pockets, and other detrimental defects. Water passageways in said bowls shall be smooth so as to allow freedom from cavitation and permit maximum efficiency. Each bowl shall have end or side seal (or both) to prevent slippage of water between bowl and impeller. Each bowl shall be assembled with stainless steel bolts.

Bowls shall be lined with vitreous porcelain enamel, or equal, to produce long effective life (said lining shall not be applied for the purpose of short time gain in efficiency). Lining, identical to that furnished hereunder, shall have been used in the field under similar conditions with satisfactory results for at least a five-year period.

Bowls shall be of such size to fit the well casing with proper clearance (net clearance of 2 inches or more). Bowls shall be capable of withstanding 1-1/2 times the pump shut-off head pressure (zero discharge) or twice the rated capacity pressure, whichever is greater. Bowl materials shall have a minimum tensile strength of 30,000 psi.

B. Pump Impellers

Impellers shall be of the enclosed type, constructed of polished Type 316 stainless steel. They shall be balanced dynamically to prevent vibration and shall be smoothly finished on all surfaces for minimum friction. Impellers shall be accurately fitted and securely locked to the pump shaft. Vertical adjustment of impellers shall be possible by adjusting top shaft nut. Each impeller shall be identical in size. When trimming impellers is required to meet hydraulic performance requirements, all impellers shall be identically trimmed to achieve the requirements.

C. Pump Shaft

Pump shaft shall be constructed of AISI-410 or 416 stainless steel and shall be accurately machined to provide smooth operation. It shall easily withstand torsional loads and other stresses encountered within the pump. Pump shaft shall have adequate bearing support at every bowl section and at top bottom and case section, and shall be equipped with a suitable steel coupling for connection to the line shaft.

D. Pump Bearings

Pump bearings shall be sleeve type constructed of SAE 40, 64, 67, or 660 bronze, or approved equal. Bearing area, bearing cooling, and bearing lubrication shall be ample for long, trouble-free operation.

E. Discharge Case

Discharge case shall securely fasten the pump bowl assembly to the column piping. It shall be heavily reinforced with streamlined fluid passages and it shall contain sleeve bearings for the pump shaft. Discharge case shall be provided with a means of reducing to a minimum the leakage of water into the shaft enclosing tube. It shall have bypass ports of sufficient area to permit the escape of water that leaks through the seal bushing.

F. Suction Case

Suction case shall securely fasten the suction piping to the bowl assembly. It shall be heavily reinforced with streamlined fluid passages and it shall contain a sleeve bearing for the pump shaft which is effectively plugged at the bottom to form a grease container. A sand collar shall prevent sand from entering the suction case bearing.

G. Suction Pipe and Strainer

Unless specified otherwise, the suction pipe shall be 10 feet in length and comprised of the same material and diameter as the column piping. A cone type strainer shall be provided for attachment to the suction pipe. The strainer shall be stainless steel, bronze, or equivalent and shall have a net inlet area of a least four times the suction pipe area. The maximum strainer opening shall not be more than 75% of the minimum opening of the water passage through the bowl or impeller.

H. Column Piping

Column piping shall be threaded pipe conforming to the following diameters and weights per foot, unless specified otherwise.

Nominal Size (Inches)	Outside Diameter (Inches)	Weight Per Foot (Pounds)
6	6.625	18.97
8	8.625	24.70
10	10.750	34.24
12	12.750	43.77
14	14.000	54.57
16	16.000	62.58

Pipe shall be furnished in interchangeable sections of 20-foot nominal length for enclosed line shaft and 10-foot length for open line shaft, with the exception of the top column section which shall be of 5-foot nominal length and the bottom column section which may be of shorter length. Column pipe sections shall be connected with threaded steel sleeve type couplings. Ends of each pipe section shall be faced normal to section axis and machined with threads to permit ends to butt to ensure proper alignment when assembled. Coating of the column piping, either interior or exterior, is not required.

I. Line Shaft

Line shaft shall be comprised of ASTM-416 stainless steel material, or approved equal. Line shaft sections excluding top and bottom sections shall match column sections (10-foot or 20-foot nominal length). Top and bottom shaft sections shall match top and bottom column sections. Unless specified otherwise, top shaft shall be two (2) piece with coupling within discharge head.

Shaft enclosing tubing shall be Schedule 80 extra heavy steel pipe, maximum 5-foot lengths. Enclosed line shafting shall be supported by bronze bearings which shall also join tube sections. Open line shafting shall be supported by rubber bearings with bronze retainers which shall also join column sections.

When enclosed line shaft is specified, molded rubber stabilizing spiders that will deform to permit proper alignment of the shafting and tubing assembly within the column shall be furnished and spaced every 40 feet maximum throughout the column length.

2.03 Discharge Head

Discharge head shall be constructed of high grade cast iron or fabricated steel as shown on the Drawings as specified in Section 11325, Part 1.02 of the Technical Specifications, and shall be capable of withstanding all loads imposed during normal operation. Discharge head shall be furnished with a tube tension and seal assembly, as approved by Owner, for enclosed line shaft and a stuffing box assembly for open line shaft.

Discharge head shall be suitably enclosed to prevent the entrance of dust and foreign material. Access to the tube tension and seal or stuffing box assembly shall be ample and shall be equipped with a removable safety screen. Drain plugs shall be provided at the bottom. Unless specified otherwise, discharge head shall accommodate two (2) piece top shaft with coupling.

Discharge head shall have a standard flanged outlet of the size specified except where otherwise permitted. If the discharge flange is not the size specified, an adapter consisting of a smooth eccentric increaser (with bottoms level) or reducer (with tops level) shall be provided. Said adapter shall be flanged to mate the discharge head at one end and as specified at the other.

Discharge head assembly shall be capable of withstanding 1-1/2 times the pump shut-off head pressure (zero discharge) or twice the rated capacity pressure, whichever is greater.

Motor base, column flange face, and discharge flange face shall be accurately machined, faced, and drilled to NEMA and ASA Standards. Upon assembly, motor and discharge head shall form an integral unit.

Discharge head assembly shall be painted in accordance with Section 09900 of the Technical Specifications. Contractor shall submit color chart for Owner selection.

2.04 Lubrication System

Oil lubrication system shall be automatic gravity feed and it shall consist of an oil reservoir, solenoid control valve, sight feed valve, and appurtenant supports and oil lines. It shall be furnished with sight glass or other plainly visible oil indicator device.

Unless specified otherwise, oil reservoir shall have a capacity of two gallons and it shall be Peerless or approved equal. It shall be mounted on the pump discharge head unless specified otherwise.

Oiler solenoid control valve shall open or close upon command of control system and it shall be ASCO 826111, or approved equal. It shall automatically start or stop the flow of lubricating oil to the bearings. It shall also permit manual operation upon control system failure. It shall be rated 120 psi minimum, 120 volt, 60 hertz, unless specified otherwise.

Oil piping shall be sized according to the viscosity of the oil recommended by the pump manufacturer and ambient temperature at the pumping unit. Said piping shall permit conveyance of full oil supply required by pumping unit.

Water lubrication system shall be automatic unless specified otherwise. It shall consist of piping or tubing from a source of water pressurized when pump is off, solenoid control valve, and appurtenant piping supports. System shall comply with pump manufacturer's recommendations for flow.

Water solenoid control valve shall open or close upon command of control system. It shall automatically start or stop the flow of water to the shaft bearings. It shall also permit manual operation upon control system failure.

2.05 Nameplate

Nameplate, easy to read and corrosion resistant, shall be provided with each pump and shall contain complete pump information including manufacturer, serial number, model number, capacity in gallons per minute, total dynamic head in feet, and pump speed, all at specified design point. Said nameplate shall be mounted on pump head.

2.06 Vertical Hollow Shaft Electric Motor

A. General

Vertical hollow shaft electric motors shall be Design B, high thrust, squirrel cage, induction type inverter duty (where applicable) having NEMA weather protected Type I enclosures unless specified otherwise. Motors shall be built to form an integral part of pump head assembly and shall be suitable electrically and mechanically to efficiently and effectively drive pumps specified. Motors shall operate in accordance with these Specifications.

Motors shall be manufactured by General Electric Corporation, U.S. Electrical Motors Division Emerson Electric Co., or Westinghouse Electric Corporation, or approved equal. Unless specified otherwise all materials, workmanship, and tests shall conform with the applicable specifications of the National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronic Engineers (IEEE), and American Standards Association (ASA), and the Anti-Friction Bearing Manufacturers Association (AFBMA).

B. Power

Unless specified otherwise, motors shall be nameplate rated, 3 phase, 60 hertz, 460 volts.

C. Speed

Unless specified otherwise, motors shall be 4 pole and shall have no load speed of 1800 rpm.

D. Starting Characteristics

Motors rated 40 hp and smaller shall be full voltage line start and motors rated 50 hp and larger shall be part winding increment start, unless specified otherwise. Motors shall be suitable for use with reduced voltage autotransformer starters or variable frequency drives where specified.

E. Efficiency

All motors shall be rated premium efficiency, unless specified otherwise. Rated efficiencies shall be based on NEMA Standard MG1-12.536. Guaranteed efficiencies shall be determined in accordance with IEEE #12, Test Method B and E, latest revision.

F. Service Factor

Rated service factor shall be 1.15 or greater.

G. Insulation System

All motors shall be provided with Class "F" or better insulation systems except that motor lead insulation may be Class "B" or better. Impregnating materials shall be rated Class "F" (155 degrees C) minimum. Completed windings, when tested in accordance with IEEE #57, latest revision, shall show a thermal rating of not less than 150 degrees C for 30,000 hour's life.

Windings shall be held firmly in stator slots to prevent coil shift. Sharp edges and burrs shall be removed from stator slots prior to winding or inserting coils. Slot liners and coil end phase insulation, in addition to the coating, shall be provided. Stator windings shall be of high conductivity copper magnet wire.

Completed stator windings shall be provided with a properly cured, uniform impregnation for mechanical rigidity, moisture resistance, and protection against winding failures from accumulation of foreign conductive matter. The completed insulation system shall be capable of withstanding phase-to-ground root mean squared (rms) voltage of 600 volts continuous and 2,300 volts instantaneous (surge or transient).

H. Temperature Rise

Rated temperature rise above 40 degrees C ambient temperature measured by resistance at service factor load of 1.15 shall not exceed 90 degrees C.

I. Inrush Current

Motors rated between 10 hp and 50 hp shall be rated NEMA locked rotor Code H or better and motors rated 50 hp and larger shall be rated NEMA locked rotor Code G or better except where NEMA locked rotor Code H is specifically permitted.

J. Load Conditions

Actual motor loads shall not exceed the nameplate rating (horsepower) unless specified otherwise.

K. Motor Balance

Motors shall be dynamically balanced to a maximum of .001 inches peak to peak amplitude, especially at upper bearing housing.

L. Bearings

Motors shall be equipped with anti-friction type thrust and guide bearings. Angular contact ball thrust bearings shall be used in preference to spherical roller thrust bearings wherever possible. Angular contact ball thrust bearing shall be self cooled wherever possible. Water cooled angular contact ball thrust bearings shall be used only when approved by Owner. Spherical roller thrust bearings shall be water cooled.

Bearings shall be of sufficient capacity to carry all static and dynamic up and down thrust loads, both momentary and continuous, imposed by the pump. Bearings shall provide minimum 5 year B10 life (40,000 hours) based on continuous design thrust load or minimum 1 year B10 life (8770 hours) based on maximum pump shutoff thrust load, whichever is greater. Bearings shall also provide for minimum momentary upthrust equal to 30% of rated downthrust.

M. Bushings

Motors shall be equipped with lower end head shaft steady bushings unless specified otherwise.

N. Lubrication System

Motor thrust bearings shall be oil lubricated; however, motor guide bearings may be grease lubricated. Oil lubrication systems shall provide optimum lubrication of bearings. Said systems shall have sufficient oil storage and oil cooling capacity to limit oil bath temperature rise to 45 degrees C above 40 degrees C ambient temperature unless temperature rise of 50 degrees C is specifically permitted. Oil lubricated motors shall have visual level indicators and accessible fill and drain plugs. Indicators and plugs shall be located 180 degrees from pump discharge unless specified otherwise. Grease lubrication systems shall be regreasable and shall provide for automatic flushing or purging of grease cavity during regreasing.

O. Thermal Protection

Motors shall be equipped with 120 volt thermal sensors, one for each phase, affixed to or embedded in motor windings, set to open control circuit at 135º C. All thermal sensor leads shall terminate in motor terminal box. Control modules and reset switches shall be furnished with the thermal sensors. The thermal sensors shall be Positive Temperature Coefficient (PTC) type. Control modules and sensors shall be as manufactured by Klixon (Texas Instruments), U.S. Motors, G.E., or equal and shall have automatic reset with 4-minute time delay. Sensor and control modules shall be coordinated and control modules shall be provided and delivered with the equipment for installation by others.

P. Space Heaters

Motors shall be equipped with 120 volt single phase belt type space heaters capable of raising motor temperature 10 degrees C above ambient temperature to prevent condensation. All space heater leads shall terminate in motor terminal box. Space heater sizing shall be determined by motor frame size and space heater manufacturer's sizing charts. Space heaters shall be manufactured by Electro-Film or approved equal.

Q. Non-Reverse Protection

When possible, provide non-reversing ratchets for vertical hollow shaft (VHS) motors driving pumping equipment. Contractor shall coordinate with the pumping equipment manufacturer and VHS motor manufacturer to ensure it is suitable for the pumping application. Contractor is responsible for confirming the driven assembly inertial force does not exceed the capacity of the non-reversing ratchet. If non-reversing ratchet cannot resist the torque generated from inertial forces, then the motor and driven equipment shall be capable of withstanding reverse rotation without damaging the motor or driven equipment. For inverter rated VHS motors operating with VFD systems, motor manufacturer shall ensure that the non-reversing ratchet will not interfere with motor operation at the minimum pumping unit speed, including causing a locked rotor or VFD tripping.

Motors equipped with non-reverse mechanisms shall limit maximum reversal to within 10 degrees of rotation. Said mechanism shall be attached to the head shaft using an "L" shaped GIB key and installed between driver and shaft.

R. Conduit Terminal Box

Motors shall be equipped with extra large (one size larger than standard) heavy duty split type conduit boxes. Unless specified otherwise, motor conduit boxes shall be located 90 degrees from pump discharge.

S. Screens

Motors shall be equipped with suitable corrosion resistant safety and rodent screens. Said screens shall not interfere with motor cooling or motor heat dissipation.

T. Nameplates

Nameplates, easy to read and corrosion resistant, shall be provided with each motor and said nameplates shall include the following information:

1. Motor Data Nameplate

   Manufacturer, serial number, model number, rated horsepower, service factor, frequency, phase, load voltage, full load current, full load speed, design designation, locked rotor-code, insulation class, temperature rise, ambient temperature, thermal sensor setting, NEMA nominal efficiency, guaranteed minimum efficiency, full load power factor, and inverter duty rating (where applicable).

2. Connection Data Nameplate - Motor start, motor run characteristics, and motor connection diagram.

3. Bearing Data Nameplate - Manufacturers, bearing types (thrust and guide), bearing numbers, thrust capacity, oil type, minimum operating oil viscosity, maximum operating oil bath temperature, required cooling water flow, and maximum cooling water pressure.

U. Painting

Electric motor manufacturers shall prepare and prime surface of motor case. Prime coat shall conform to Section 09900 of the Technical Specifications. Prime coat shall be compatible to final paint system. Prime coat and final color coat shall be a minimum 3 mils thickness each for a total minimum coating thickness of 6 mils. Contractor shall submit color chart for Owner selection.

PART 3 - EXECUTION

3.01. Pumping Unit Factory Performance Test

Unless specified otherwise, each completed pumping unit (pump bowl assembly and vertical hollow shaft motor to be furnished) shall be given a certified factory performance test by pump manufacturer prior to shipment from factory. Test procedures and operations shall conform to the applicable requirements of the Hydraulic Institute Standards, except as modified herein. Pumping unit shall be tested at all design points for verification of certified manufacturer's pump performance curve furnished by Bidder and approved by Owner. Manufacturer shall guarantee pumping unit performance at specified operating conditions, including flow, total dynamic head, and efficiency. The certified factory test logs and performance curves shall be signed by an officer of the manufacturing company.

Tests shall be performed using suitable equipment for measuring bowl capacity, bowl head, power (input, brake, and water), and speed, all as approved by Owner. Equipment shall include a power meter for measuring input power (wire), a dynamometer for determination of pump brake horsepower, and a water meter for measuring output power (water). Contractor shall submit three copies of each certified factory pump performance test for acceptance by Owner. Unless specified otherwise, Owner will have a representative present during any tests to witness same. Owner shall be notified at least two (2) weeks in advance of factory performance testing.

3.02 Well Disinfection

Immediately prior to performance of the final well video and before installation of permanent pumping unit), Contractor shall disinfect the well with chlorine. Unless otherwise permitted, Contractor shall use the following procedure to disinfect the well:

A. Contractor shall dose the well with chlorine by adding granular 70% calcium hypochlorite (HTH, Perchloron, Pittchlor) to the well to obtain the required concentration of at least 100 ppm (1-1/4 pounds dry weight per 100 feet). The calcium hypochlorite granules shall not have been stored more than one (1) year.

B. Contractor shall add the granular calcium hypochlorite to the well using a perforated bailer. Contractor shall raise and lower the bailer approximately three (3) times within each 20 foot long segment of the submerged casing, beginning at the top.

C. Contractor shall then allow the well to stand without agitation for 24 hours.

D. Contractor shall then dechlorinate the well with sufficient sodium thiosulfate solution (or equivalent) to result in a chlorine residual of less than 0.1 ppm throughout the depth of the well.

E. Contractor shall then perform video logging of the well in accordance with Part 3.03 of these Specifications.

F. Contractor shall then complete installation of the pumping unit in accordance with Part 3.04 of these Specifications.

3.03 Video Logging of Well

Contractor shall provide one (1) color video log for the well prior to pumping unit installation. Contractor shall provide equipment that is capable of producing a clear video image of the well casing both submerged and out of the water. The camera must be capable of providing a clear video image of the well and must be capable of displaying a right angle, side-scan view of the well casing at the direction of Owner. The equipment shall indicate digitally on screen the depth of the camera within one (1) foot of its actual location at one-foot intervals. Owner must be present during the video scan. Contractor shall provide a written field log of the observations from each video scan. A DVD (two (2) copies) of each inspection scan shall be provided to the Owner upon completion of each video-logging run. Contractor shall schedule the video logging with the Owner at least two (2) working days in advance. Prior to performing video log, water shall be added to the well in sufficient quantity and for sufficient duration to clarify the water in the well.

3.04. Pumping Unit Installation

Contractor shall bear full responsibility for the satisfactory installation and initial operation of all pumping units furnished under these Specifications and shall provide sufficient personal supervision over all installation and startup procedures accordingly, unless otherwise specified. Contractor shall also provide all test equipment necessary to determine initial operating performance.

Contractor shall disinfect the well and thereafter perform a video survey of the well and review same with Owner.

During installation, Contractor shall disinfect all portions of the pump bowl assembly and column piping with a chlorine solution and method acceptable to Owner.

3.05. Well Disinfection After Installation of Permanent Pumping Units

Upon installation of permanent pumping unit, Contractor shall use the following procedure to disinfect the well:

A. Contractor shall then secure two (2) samples of water from the well at the pump discharge in approved containers, and have said samples analyzed by a State-certified analytical laboratory for chlorine residual, total coliform (presence/absence), *e. coli* (presence/absence), and heterotrophic plate count. Contractor shall secure the first sample within five (5) minutes of starting the pump at the specified pumping rate, and the second sample thirty (30) minutes thereafter. Contractor shall furnish results of said analyses to Owner within 48 hours of sampling. Contractor shall perform all procedures and provide all tests and analyses at his own expense.

B. The well shall be deemed properly disinfected only if the sample analysis results indicate absence of total coliform bacteria, absence of *e. coli* bacteria, and a heterotrophic plate count of less than 500 colony forming units per milliliter (CFU/ml).

C. If the sample analysis results do not indicate that the well was properly disinfected, the Contractor shall use the following procedure to disinfect the well:

1. Contractor shall dose the well by adding liquid chlorine solution to well to obtain required concentration of at least 100 ppm.

2. Immediately after dosing the well, Contractor shall pump water to ground surface until chlorine is detected and shall then allow the water to return into the well. Contractor shall repeat said procedure twice at one hour intervals.

3. Contractor shall then allow the well to stand without pumping or agitation for 24 hours.

4. Contractor shall then pump the well to waste until chlorine is no longer evident, and shall continue to pump the well to waste for fifteen (15) minutes thereafter.

5. Contractor shall then allow the well to stand without pumping or agitation for 24 hours prior to sampling.

6. Contractor shall then secure two (2) samples of water from the well in approved containers, and have said samples analyzed by a State-certified analytical laboratory for total coliform (presence/absence), fecal coliform (presence/absence), and heterotrophic plate count. Contractor shall secure the first sample within five (5) minutes of starting the pump at the specified pumping rate, and the second sample thirty (30) minutes thereafter. Contractor shall furnish results of said analyses to Owner within 48 hours of sampling. Contractor shall perform all procedures and provide all tests and analyses at his own expense.

7. The well shall be deemed properly disinfected only if the sample analysis results indicate absence of total coliform bacteria, absence of fecal coliform bacteria, and a heterotrophic plate count of less than 500 colony forming units per milliliter (CFU/ml).

8. If the sample analysis results do not indicate that the well was properly disinfected, the Contractor shall repeat the entire disinfection procedure, including sampling, sample analysis, and reporting of sample analysis results. Contractor shall continue to repeat the entire disinfection procedure until sample analysis results indicate that the well has been properly disinfected. Contractor may increase the chlorine dosage, but shall not increase the chlorine dosage above 500 ppm without Owner's authorization.

3.06 Pumping Unit Field Performance Test (Acceptance Test)

Following completion of the installation and satisfactory startup of the equipment, the Contractor shall provide the services of the pump manufacturer's representative to assist and coordinate operation of

each pumping unit over the entire specified range. The operation shall be performed by the Contractor over the entire specified range and shall be free of excessive vibration, noise or cavitation, overheating of the pump or motor bearings, and overloading the motor. The pump manufacturer's representative shall supervise the following tasks and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation. Contractor shall provide all required testing equipment and shall perform said test at no additional cost to the Owner. Contractor shall provide all instrumentation to confirm pumping unit and electric motor performance, including calibrated test gauges for monitoring suction and discharge pressure, certified pitot tube(s) for monitoring flow, calibrated vibration test equipment, and electrical monitoring equipment to measure current, voltage, power, kVA, and power factor.

A. Completed pumping unit (pump and motor) shall receive a final field trim balance, as may be required, and vibration of unit shall not exceed 0.0025", peak to peak amplitude when operating. Contractor shall provide a suitable calibrated instrument to field measure vibration and all measurements shall be witnessed by Owner. Vibration shall be measured at motor thrust bearing housing and at any other locations on pumping unit as directed by Owner. Vibration shall be measured over the full range of the pump operating speed.

B. Each pump's performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump flow rate, pump suction head, and pump discharge head. Readings shall be documented at a minimum of four pumping conditions, including the specified design point, to ascertain the actual pumping curves. Another test shall be run at shut-off head. Each power lead to the motor shall be checked for proper current balance.

C. Pumping units (pump and motor) shall perform in the field substantially in accordance with the certified pump curves and the factory performance test results as adjusted for field conditions. If, in the opinion of Owner, the equipment furnished does not perform in accordance with these Specifications, Contractor shall promptly make all necessary repairs or corrections so that the equipment fully complies with these Specifications. Contractor shall remove, restore, and replace the equipment if required. Factory and field performance tests shall be rerun if necessary. Pump manufacturer's field service engineer shall assist Owner in the proper conduct of the above field acceptance tests.

3.07 Certification of Installation

Contractor shall submit a letter to the Owner confirming that all pumping equipment was inspected, operation checked, and installation approved in writing by the respective pumping Equipment Supplier prior to operation of the equipment.

END OF SECTION

SECTION 11325
PROJECT SPECIFIC DEEP WELL VERTICAL TURBINE PUMPING UNIT TECHNICAL SPECIFICATIONS

This Section amends and/or supplements portions of Section 11320, Deep Well Vertical Turbine Pumping Unit Specifications of the Technical Specifications, and shall have precedence over same.

PART 1 - GENERAL

1.01 Specific Project Description

Contractor shall furnish and install a Deep Well Vertical Turbine Pumping Unit as specified herein and shown on the Drawings. Pumping unit shall be suitable for installation in Well No. 1 and shall include pump and motor.

1.02 Specific Project Pumping Unit Requirements

A. General

Pumping unit data per Section 11320, Part 1.03 of the Technical Specifications shall not be submitted with bid, but shall be submitted as part of the Contractor's Submittals. Factory performance test as specified shall be performed.

Well shall be disinfected per Part 3.02 of Specification Section 11320. Well shall be video logged per Part 3.03 of Specification Section 11320.

B. Well No. 1 Pumping Unit

Contractor shall furnish and install one (1) pumping unit with enclosed line shaft (oil lubricated) and enclosed stainless steel impellers.

1. Pumping unit shall provide the following performance at a full load speed of 1,770 rpm:

Flow (gpm)	Total Dynamic Head (feet)	Minimum Bowl Efficiency[1] (%)
800	924'± 3	82%
1,000*	826'	83%
1,200	689± 3	76%

* Design condition
[1] Minimum Hydraulic Efficiency per Hydraulic Institute 1E

2. Minimum shut-off head shall be 1,060 feet.

3. Motor shall be vertical hollow shaft, premium efficiency, 1,800 rpm (maximum), 300 horsepower (maximum), 4 pole, soft start, 460 volt, 3 phase, 60 hertz with space heaters. No point on the pump performance curve at maximum speed shall exceed motor horsepower. Motor shall also have the following features:

   a. Guaranteed Minimum Efficiency - 94% @ full load.

   b. Motor Leads - 18" long minimum.

   c. Motor Terminal Box shall be 16" x 16" x 14" and equipped with 4" threaded opening for power cables.

   d. Minimum Thrust Bearings Rating - 3 year B10 operating, 1 year B10 shutoff.

4. Contractor shall recondition existing 12" flanged fabricated steel discharge head with. Head shall be sandblasted, inspected, and coated per Specification Section 09900. Motor shall mate to existing discharge head. Contractor shall verify dimensions of existing discharge head.

5. Maximum pump bowl assembly diameter shall be 12" for the well, which has a 16" I.D. casing. All bowls shall be the same model and all impellers shall be the same model and trim.

6. 10" diameter column pipe shall be provided (approximately 860 feet in length).

7. 10-foot long suction pipe and with stainless steel cone type strainer shall be provided for the pumping unit.

8. 1-15/16" diameter line shaft and 3" diameter tubing shall be provided (each approximately 860 feet in length).

9. Pump shall be manufactured by a manufacturer listed in Specification Section 11320. Preliminary pump selection is as follows:

   Xylem (Goulds) 12CMC (12-Stage)

   Alternative pumps will be evaluated for acceptability based on the "steepness" of the pump curve between 800 gpm and 1,200 gpm and the design condition 1,000 gpm @ 826 ft TDH.

10. The bottom of suction tube and strainer shall be set at depth of 880 feet below ground surface.

11. An airline constructed of 1/4" PVC-coated stainless steel tubing shall be set at 850 feet, fastened to column with stainless steel bands at each joint. Gauge shall be 4-1/2" diameter U.S. Gauge Figure 566S (range 0 to 600 feet) with fill valve, airline and pressure gauge mounted to pump discharge head with rigid metal bracket.

12. Contractor shall utilize existing oil reservoir and associated piping.

13. Pump manufacturer shall verify that bowl assembly has sufficient axial clearance to accommodate elongation of existing line shaft (at pump shut-off, zero flow).

14. Static water level is 740 feet below ground surface.

15. Pumping water level is 780 feet below ground surface.

16. Well Screen: 16" ID wire wrap (mild steel)

17. Fluid Pumped: Well water (chemical analysis available upon request), Specific gravity = 1.0

END OF SECTION